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Report on the School of Mechanical Engineering National Technical Center Saigon, South Vietnam

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REPORT ON
THE SCHOOL OF MECHANICAL ENGINEERING
NATIONAL TECHNICAL CENTER
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INTRODUCTION

Training in the discipline of Mechanical Engineering is offered in South Vietnam by the School of Mechanical Engineering, one of four engineering schools and a Merchant Marine School composing the National Technical Center located presently in the Phu Tho region of Saigon, South Vietnam. The school was established in 1956 for the training of engineers for mechanical and industrial activities. It became part of the National Technical Center, established by Decree No. 213-Gd by the President of the Republic of Vietnam on June 29, 1957 and graduated the first class of 20 in the summer of 1960. The KS Degree, Ky Su, pronounced "Key Suh", meaning engineer, in mechanical engineering is offered and 187 students to date have graduated. For a breakdown by year see Table 1. The 1969 - 1970 enrollment was 153 of which 27 graduated at the end of August.

A student wishing admission to one of the National Technical Center schools must have successfully completed an Academic Baccalaureate II in the area of mathematics, in general science if he also obtains a certificate in science or math from one of the universities, or in technology. Admission is highly selective and determined by competitive examination.

TABLE 1

KS* DEGREES GRANTED IN MECHANICAL ENGINEERING

Year	Number of Graduates
1959 - 1960	20
1960 - 1961	17
1961 - 1962	15
1962 - 1963	16
1963 - 1964	10
1964 - 1965	16
1965 - 1966	21
1966 - 1967	23
1967 - 1968	25
1968 - 1969	24
1969 - 1970	27

*Ky Su, pronounced "Key Suh"

In the School of Mechanical Engineering one half of the admission seats are allotted to Academic Baccalaureate II holders and the remaining to Technology Baccalaureate II holders. The former are well versed in mathematics and the latter in mechanical drawing and practical fundamentals. The first year is used to equalize these two groups by emphasizing industrial drawing for the Academic Baccalaureate II students and mathematics for the Technology Baccalaureate II students. The remaining curriculum is the same for both groups.

The educational program is one where a class progresses as a unit through the curriculum, there being no multiple sections. Although semester scheduling is used, many courses run for the entire academic year. There is little homework and few examinations throughout the year. Final examinations are administered at the end of the academic year in each course subject offered. A student's average over all these exams must be passing to qualify him to go into the next year's work. Failure to qualify means repeating the entire year's work, if accepted to do so by the faculty.

Organization

The engineering school organization comprises a director of the school, an assistant director, a committee of professors and a clerical staff. The committee of professors is presided over by the director of the school and includes as members the assistant director and the professors of the school.

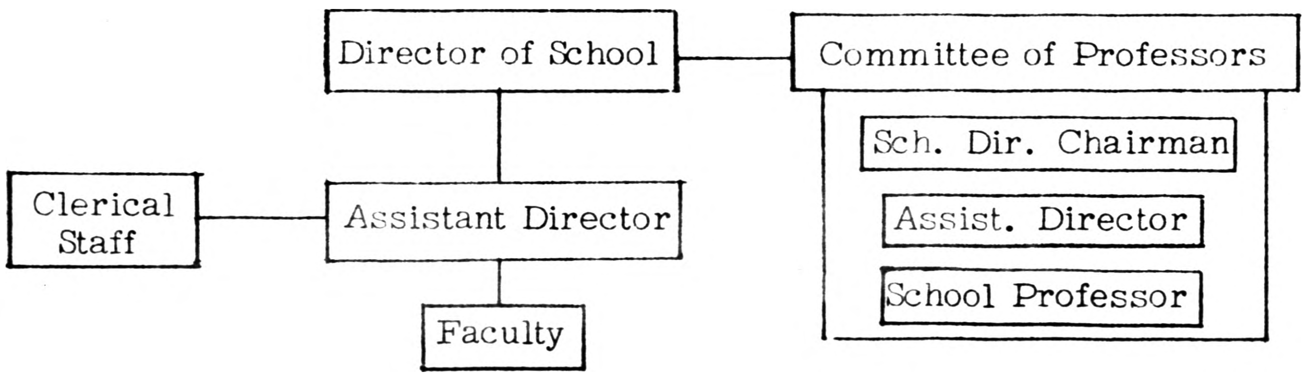

FIGURE 1 School Organization

The School Director, under the direction of the Director of the National Technical Center and the Minister of Education, and with the assistance of the Committee of Professors, administrates the affairs of the department. He is assisted by an Assistant Director and a clerical staff. He functions as a liaison between the faculty and the Director of the Center. Matters pertaining to the internal affairs of the school are handled by the committee of professors. These include setting standards, curriculum, planning, expenditures of available funds, etc.

The Assistant Director, a full time faculty member, is appointed by the Director of the School. The School Director nominates employees for his clerical staff through the Director of the Center and they are approved by the Ministry of Education.

Prospective faculty members are nominated by the School Director and the Director of the Center and are appointed by the Ministry of Education.

Faculty

The faculty in the School of Mechanical Engineering is composed of five Master of Science degree holders, three Ky Su degree holders, one B. S. in physics and chemistry, one Ph. D. in metallurgy, one Ky Su degree holder who is working towards a Master of Science as a USAID participant at the University of Missouri - Rolla, and Mr. Dao Kim who is finishing his Ph. D. in Mechanical Engineering at the University of Wisconsin and is expected to make a big contribution to the ME school upon his return.

Two faculty members holding the Ky Su degree graduated in 1968 and have been kept from formal teaching until there are several years between their graduation class and the current class members. They have been used for supplemental instruction in shop work. Table 2 identifies the full time engineering faculty members of the School of Mechanical Engineering.

The school also has 9 technical level teachers who teach the shop courses. See Table 3. They are considered part of the faculty and influence the old tendencies to stay with too much shop work in the curriculum.

Extensive use is made of 16 part time faculty members who teach nominally only one course ranging from 1 - 3 hours per week. Table 4 lists these faculty members. The teaching roster for 1969-70 is compiled in Appendix A.

In the classroom, lectures are given in Vietnamese except in the courses taught by the three aid programs; AID France, UNESCC, and USAID where English or French is used. In courses where texts are used, they are either English or French. The difficulty the student has being confronted with a trilingual educational system is paramount.

Many courses have no textbooks and lecture notes are the only contact the student has with his subjects. Some professors give the notes in advance and the students go together and have copies made.

TABLE 2

MECHANICAL ENGINEERING FACULTY

Phung Van Bo	BS	Physics and Chemistry	1962	Saigon University
Pham Quoc Cuong	KS	Mechanical Engineering	1968	Phu Tho NTC
*Tran Minh Giam	PhD	Mines and Metallurgy	1966	Laval University
	BS	Mines and Metallurgy	1964	Montreal, Canada
*Le Manh Hung+	MS	Naval Construction and Marine Architecture	1965	Mass. Institute of Technology
*Vu Trong Khoi+	MSME	Machine Design	1967	Michigan State
	BS	Mechanical Engineering	1966	Cornell University
*Dao Kim+	PhD	Heat Transfer	1971++	Univ. of Wisconsin
	MS	Heat Transfer	1964	Southern Ill. Univ.
	KS	Mechanical Engineering	1961	Phu Tho NTC
*Tran Van Phat	KS	Mechanical Engineering	1968	Phu Tho NTC
*Nguyen Don Phu +	MSME	Strength of Materials	1967	Stanford
	KS	Mechanical Engineering	1964	Phu Tho NTC
*Nguyen Hoang Sang	MES	Fluid Mechanics	1967	Univ of West Australia
	BE	Mechanical Engineering	1964	
Nguyen Thanh Tong	KS	Mechanical Engineering	1968	Phu Tho NTC
*Nguyen Khanh Van +	KS	Mechanical Engineering	1960	Phu Tho NTC
*Nguyen Quang Van +	MSME	Heat Transfer	1967	New Mexico
	KS	Mechanical Engineering	1964	Phu Tho NTC

*Speak English
+USAID participant (past or present)
++Expected completion date

Dao Kim is in the U.S. finishing his PhD as a USAID participant
Nguyen Thanh Tong is attending UNESCO training in Italy
Nguyen Khanh Van is a USAID participant for the MS degree at UMR

TABLE 3

TECHNICAL FACULTY

NAME	TRAINING	SPECIALIZATION
Nguyen Tri Tin	Polytechnic Phu Tho	Forging
Le Dang Nguyen	Polytechnic Phu Tho	General Maintenance
Mai Binh Phuc	Polytechnic Phu Tho	Foundry and Pattern Making
Le Minh Du	Equiv. Technical Pedagogy	Machining
Huynh Van Chinh	Equiv. Technical Pedagogy	Machining
Do Ky	Polytechnic Phu Tho	Metallurgy
Le Van Phu	Equiv. Technical Pedagogy II	Machining
Huynh Lien Huu	Equiv. Technical Pedagogy	Welding
Nguyen Van Man	Equiv. Technical Pedagogy	Machining

TABLE 4

MECHANICAL ENGINEERING

Part Time Faculty

1.	Nguyen Nhu Bien	KS, Mechanical Engineering - Refrigeration Industry
2.	Lam To Bong	KS, Textiles- Business Administration
3.	Tran The Can	MS, Mechanical Engineering
4.	Nguyen Nang Cuong	KS, Mechanical Engineering - Industrial Drawing
5.	Khuong Hong Chan	MSCE - English
6.	Luu Huu Dung	MSCE - Analysis (Math)
*7.	Bui Tien Hoang	MS, Law-Industrial Computation
*8.	Vo Van Hoang	KS, Mechanical Engineering - Professional Guidance
9.	Chau Tam Luan	PhD, Economics-Economics
10.	Nguyen Huu Minh	KS, Electrical Engineering
11.	Nguyen Van Ngan	KS, Law-Commercial and Labor Law
12.	Bui Van Nghiem	KS, Electrical Engineering, Power Plants
13.	Do Ngoc Canh	KS, EIM - Heat Engines
14.	Nguyen Han Ty	KS, Electrical Engineering - Industrial Electricity
15.	Van Dinh Vinh	KS, ESE, IAM - Industrial Drawing
16.	Nguyen Van Tan	MS, Metallurgy - Metallurgy

* Not on 1969 - 1970 Roster

This is particularly helpful to the student but is more the exception than the rule. The rule is the transmittal of the subject via the blackboard. Available library materials are quite inadequate.

Effective teaching and improved learning processes must be developed. Transmittal of engineering notes, problems, methods, charts, etc. to the student is a must. A central reproducing facility for the institute with individual school capability in ditto and mimeograph would help to improve classroom instruction 100 percent.

A full time teaching load is considered as 6 hours per week and little time beyond a maximum of one-half day is devoted by the faculty to their primary job which affords them a draft exempt status. Their supposedly secondary jobs receive more time and rewards the personnel with a much higher income than do their primary academic positions. Activities beyond the teaching of these 6 hours are minimal and consequently there is no major input to the institution from the faculty outside their normal teaching activities. Laboratory development, long range planning, academic and professional activities, etc. are thus lacking due primarily to an economic situation.

The School of Mechanical Engineering has an in-house production program where faculty members compete for production contracts.

The shop facilities are used and the School receives a percentage for utilities, equipment modernization and for a student fund. The technical faculty supplement their salary by this means whereas most of the engineering level faculty go off campus. Such items are moldings, mail carts, furniture, cable clamps, motor mounts, etc. are produced.

To summarize, there are twelve professional level faculty members in mechanical engineering, three of whom are abroad furthering their studies. There are nine technical level faculty members and sixteen part-time instructors who are drawn from industry to teach. Nine Center faculty members are used to teach core subjects such as math, physics, and chemistry. This gives a total of 46 personnel used to sustain the mechanical engineering curriculum.

The number of full-time equivalent (FTE) faculty members is determined by taking the total degree credit requirements, adjusting for the number of elective hours offered and dividing by the annual teaching load required of a faculty member.

The KS Degree in Mechanical Engineering requires approximately 204 credit hours and there are 12 hours of courses falling into the elective category over and above the 204 hours. Based on an annual teaching load of 12 hours (6 per semester), the full-time equivalency

(FTE) is:

FTE faculty = 216/12 = 18

This figure, of course, is tempered by the use of Center personnel who teach common courses for all the four schools. So, for mechanical engineering there are 158 hours of courses taught by non-Center personnel leaving 57 hours taught as common core. This gives a mechanical engineering equivalency of:

FTE (ME) = 158/12 approximately 13

No administrative or non-professional time has been accounted for in these figures. The school administrative input of academic level personnel might add a half time equivalency to this figure giving 13-1/2 FTE positions in the School of Mechanical Engineering.

The student to faculty ratio for mechanical engineering students and faculty is 153/18 = 8. 5. It is interesting to compare this figure with those for the entire National Technical Center and for U. S. institutions keeping in mind the fact that a full-time annual load is 12 hours here and 24 hours in U. S. institutions.

A survey of 14 average colleges of engineering in the U. S. has revealed that the ratio of full-time equivalent students to faculty is about 10/1 if 1/6th of the schools enrollment consists of graduate students.[1] Since most schools have graduate programs, separate information may be difficult to obtain without a specific questionnaire survey. The schools with a low percentage of graduate students, less than 5%, had ratios around 15/1 and these figures may run as high as 20/1.

During the 1969-70 academic year 524 full-time students were enrolled in engineering at the National Technical Center. Each curriculum consists of approximately 205 credit hours giving for the entire school 820 credit hours minus the fourth year in chemical engineering, or approximately 770 credit hours. With a realistic teaching load of 12 credit hours per semester on a FTE basis or a yearly total of 24 credit hours and a decrease in the number of credit hours required for the engineering degree, the student to faculty ratio (FTE basis) might easily be 15/1 or during difficult times could even be higher. The increase in this ratio and salaries are the real keys to increasing enrollments and faculty involvement in engineering education. Thus, it is feasible to essentially double the enrollment and double the student to faculty ratio with only an increase of 15-20% in the faculty.

For another view of the teaching load in the Mechanical Engineering School, consider the ratio of student credit hours to FTE faculty as

( ) Denotes Reference

follows:

TABLE 5

1969-70 School Year Student Credit Hours

CLASS	1st	2nd	3rd	4th	
Credit Hours	52	46	52.5	53.5	
No. Students	50	45	31	27	
Student Credit Hours	2600	2070	1627.5	1444.5 =	7742

So, the ratio of student credit hours to FTE (12) faculty is

$$SCH/FTE\ (12) = 7742/18 = 430.$$

Since 2FTE (12) = FTE (24), the equivalent ratio for comparison with U.S. institutions would be

$$SCH/FTE\ (24) = 215.$$

It must be noted that FTE is an arbitrarily set teaching load and for comparative purposes 24 annual academic credit hours are used to establish one FTE faculty member. The actual number of faculty may differ considerably from the FTE figure.

In comparison, assuming an average class size of 30 students and an FTE teaching load of 24 hours annually, the SCH/FTE ratio is 840. Yet, the average value for 14 engineering universities in the

Southeastern region of the United States is 274 student credit hours per full-time equivalent faculty member with 231 as a minimum and 439 for a maximum. These figures are for engineering students and classes only and consider an annual load to be 24 credit hours. Non-engineering faculty and courses are excluded.

These schools have a graduate enrollment in engineering averaging 15.1% with a minimum of 4.3% and a maximum of 26.2%. No information on undergraduates was available separately. Therefore, this accounts for the seemingly low figure for the SCH/FTE faculty ratio.

Mechanical Engineering Curriculum

The mechanical engineering curriculum of the 1969 - 70 academic year, Table 6, requires 204 hours of semester credit for the Ky Su degree. The total curriculum contains 47 semester credit hours of lab and shop work which is approximately 122 hours per week of work, or a student spends approximately two full 8 hour days in the shop per week. With military training taking one full day and no classes scheduled on Sunday, the remaining curriculum occupies only three days per week.

In the first two years the student is taught in the fundamentals of

TABLE 6

MECHANICAL ENGINEERING 1969 - 1970 CURRICULUM

Freshman Year

FIRST SEMESTER

	Course	Hrs/Wk	Semester Credit Hours
101	Manufacturing Processes and Materials	3	3
*102	Industrial Drawing A	3	1
	B	4	1
104	Algebra	2	2
106	Calculus	3	3
**107A	Mechanics and Sound	3	3
107C	Electricity	3	3
107D	Physics Lab	3	1
108A	Inorganic Chemistry	3	3
108B	Chemistry Lab	3	1
114	French	3	3
118	Physical Education	2	0
	Shop	8	3
			27

SECOND SEMESTER

	Course	Hrs/Wk	Semester Credit Hours
101	Manufacturing Processes and Materials	3	3
*102	Industrial Drawing A	3	1
	B	4	1
104	Algebra	2	2
105	Analytical Geometry	2	2
106	Calculus	3	3
107B	Thermodynamics	3	3
107D	Physics Lab	3	1
108B	Chemistry Lab	3	1
116	Economics	2	2
115	English	3	3
118	Physical Education	2	0
	Shop	8	3
			25

*A Previous Drawing Experience
B No Drawing Experience
** 107 (A, B, C, D) Physics Series

MECHANICAL ENGINEERING 1969 - 1970 CURRICULUM

Sophomore Year

FIRST SEMESTER

	Course	Hrs/Wk	Semester Credit Hours
201	Manufacturing Processes and Materials	3	3
202	Industrial Drawing	3	1
204	Calculus	3	3
205	General Mechanics	2	2
208	Thermodynamics	3	3
210	Electricity	2	2
212	Physics Lab	3	1
215	English	3	3
216	Strength of Materials	2	2
218	Physical Education	2	0
	Shop	8	3
			23

SECOND SEMESTER

	Course	Hrs/Wk	Semester Credit Hours
201	Manufacturing Processes and Materials	3	3
202	Industrial Drawing	3	1
204	Calculus	3	3
205	General Mechanics	2	2
209	Optics	3	3
210	Electricity	2	2
212	Physics Lab	3	1
214	French	3	3
216	Strength of Materials	2	2
218	Physical Education	2	0
	Shop	8	3
			23

MECHANICAL ENGINEERING 1969 - 1970 CURRICULUM

Junior Year

FIRST SEMESTER

	Course	Lect/Lab Hrs/Wk	Semester Credit Hours
303	Heat Engines	1/2	2
305	Pattern & Mold Design	3/4	4.5
306	Mechanical Vibration	3/0	3
307	Fluid Mechanics	2/0	2
309	Materials Testing	2/2.25	3
310	Metallurgy	3/4.5	5
311	Electric Machinery	1.5/4	3
315	Commercial & Labor Law	2/0	2
317	Field Trip		0
318	Technical English	3	3
320	Professional Guidance		0
321	Physical Education	2	0
			27.5

SECOND SEMESTER

	Course	Lect/Lab Hrs/Wk	Semester Credit Hours
301	Structural Design-Metal	1/2	2
302	Structural Design-Concrete	1/2	2
*307	Fluid Mechanics	2/0	2
308	Heat Transfer	3	3
311	Electric Machinery	1.5/4	3
312	Air Conditioning & Refrigeration	2	2
314	Work Organization	2	2
316	Economics	2	2
321	Physical Education	2	0
** 304	Technology of Construction Transportation Equipment	1/2	2
** 313	Design Project	3/5	5
			25

*Lab not being held

**May not be scheduled

MECHANICAL ENGINEERING 1969 - 1970 CURRICULUM

Senior Year

FIRST SEMESTER

	Course	Lect/Lab Hrs/Wk	Semester Credit Hours
403	Heat Engines	3/4	4.5
404	Machine Design	2/2	3
405	Foundry	3/8	6
406	Heat Treatment	2/2	3
407	Forging, Welding, & Molding	3/4	4.5
418	Technical English	3	3
420	Professional Guidance	1	0
421	Physical Education	2	0
434	Refrigeration	2/0	2
			26

Course Electives

431 Naval Architecture (4)
432 Power Plants (4)
435 Fuel Technology (3)
446 Computer Programming (2)

SECOND SEMESTER

	Course	Lect/Lab Hrs/Wk	Semester Credit Hours
400	Material Handling	3	3
401	Fluid Machinery	3	3
402	Steam Production & Utilization	3/2	4
403	Heat Engines	1	1
405	Foundry	0/2	1
407	Forging, Welding, Molding	0/4	1.5
408	Accounting	3	3
421	Physical Education	2	0
434	Refrigeration	2/0	2
444	Electric Machinery	2	2
	Electives	4	4
	Special Design Project	3	3
			27.5

mathematics, physics and chemistry as well as the more introductory engineering subjects such as industrial drawing, manufacturing processes, general mechanics and strength of materials. French and English are also given in the first two years.

The third year of the 1969-70 curriculum introduced the student to major engineering subjects such as heat engines, fluid mechanics, electric machinery, metallurgy, etc. Courses in structures, construction technology, refrigeration and heat transfer are also covered during this year.

The fourth year introduces machine design and fluid machinery to the student and continues to expose him to the application of electric machinery, heat engines, refrigeration and thermodynamics already thoroughly studied in the third year. Also, a large proportion of the fourth year is devoted to shop work in foundry, heat treatment, forging, welding, and molding.

The last semester of this last year the student may elect 4 hours of courses such as naval architecture, power plants, fuel technology and computer programming.

Unique to the fourth year is the special design project which requires creativity, adaptivity and a lot of work on the part of the student. This requirement was not enforced for the 1969 - 70 school year and has been dropped in the past.

An attempt has been made to refine a curriculum which will train a suitable engineer for the Vietnamese needs, one that is possible to institute readily and one which shifts the emphasis from shop work to practical engineering investigation and laboratory work. Table 7 outlines a proposed curriculum for the School of Mechanical Engineering to consider. The shop work in the areas of machinery, foundry, heat treatment, etc. have been combined with the manufacturing processes courses. The individual physics courses of the 1969-70 curriculum have been combined into a Physics I and II series to be offered concurrently with a lab. The electricity courses of the second year have been specified as electrical measurement and DC electrical networks. The previously separate strength of materials laboratory was combined to run concurrently with the course. Subjects such as heat engines, air conditioning, refrigeration and steam utilization were combined into a thermodynamics series ending in the first semester of the fourth year with applied thermodynamics. A thermo lab was proposed to run concurrently with the second of the three course series. The metal and concrete structural design courses

TABLE 7

PROPOSED MECHANICAL ENGINEERING CURRICULUM

FIRST YEAR

FIRST SEMESTER

Course	Lect/Lab Hrs/Wk	Semester Credit Hours
Introduction to Mechanical Engineering	1	1
Manufacturing Processes and Materials	3/4	4
Industrial Drawing	3	1
Industrial Drawing	4	1
College Algebra*	3	3
Trigonometry*	2	2
Physics I	4/3	5
Inorganic Chemistry	3/3	4
French	3	3
Physical Education		
		23

SECOND SEMESTER

Course	Lect/Lab Hrs/Wk	Semester Credit Hours
Introduction to Mechanical Engineering	1	1
Manufacturing Processes and Materials	3/4	4
Industrial Drawing	3	1
Industrial Drawing	4	1
Calculus & Analytic Geometry	5	5
Physics II	4/3	5
Economics	2	2
English	3	3
Physical Education		
		21

* If needed, if not, shift math series ahead one semester

TABLE 7 (con't)

PROPOSED MECHANICAL ENGINEERING CURRICULUM

SECOND YEAR

FIRST SEMESTER

Course	Lect/Lab Hrs/Wk	Semester Credit Hours
Manufacturing Processes and Materials	3/4	4
Industrial Drawing (Graphical Design)	3	1
General Mechanics I	3	3
Calculus I	4	4
Elect. Measurements	2/3	3
Strength of Materials	2/3	3
English	3	3
Physical Education	-	-
		21

SECOND SEMESTER

Course	Lect/Lab Hrs/Wk	Semester Credit Hours
Manufacturing Processes and Materials	3/4	4
Industrial Drawing (Graphical Design)	3	1
General Mechanics II	3	3
Calculus II	4	4
Electrical Networks DC	2	2
Strength of Materials	2/3	3
Kinematics of Mechanisms	2/3	3
French	3	3
Physical Education	-	-
		23

TABLE 7 (con't)

PROPOSED MECHANICAL ENGINEERING CURRICULUM

THIRD YEAR

FIRST SEMESTER

Course	Lect/Lab Hrs/Wk	Semester Credit Hours
Fluid Mechanics	2/2	3
Vibrations	3/3	4
Metallurgy	3/3	4
Thermodynamics	3	3
Electrical Networks AC	3	3
Commercial & Labor Law	2	2
Intro. Differential Equations	3	3
Physical Education*		
		22

SECOND SEMESTER

Course	Lect/Lab Hrs/Wk	Semester Credit Hours
Fluid Mechanics	2/2	3
Structural Design	3/4	4
Economics	3	3
Thermodynamics	3/3	4
Electrical Network AC	3	3
Work Organization	2	2
Construction Technology	2	2
Technical English	2	2
Physical Education*		
		23

*Optional

TABLE 7 (con't)

PROPOSED MECHANICAL ENGINEERING CURRICULUM

FOURTH YEAR

FIRST SEMESTER			SECOND SEMESTER		
Course	Lect/Lab Hrs/Wk	Semester Credit Hours	Course	Lect/Lab Hrs/Wk	Semester Credit Hours
Machine Design	3/4	4	Material Handling	3	3
Heat Transfer	3/3	4	Fluid Machinery	3	3
Electric Machinery	3/3	4	Electronics	3/3	4
Applied Thermodynamics	3	3	Accounting	2	2
Technical English	3	3	Electives	6	6
Design Project	6	3	Design Project	9	3
Professional Guidance					
Physical Education*			Physical Education *		
		21			21

Total Hours: 174
Decreased 30 credit hours from old curriculum.

*Optional

were combined into one course with a lab and the electric machinery courses which were over abundant were combined into one course in the fourth year.

The removal of the shop work from the last year made possible the introduction of six hours of electives, a definitely programmable design project, and an electronics course. Heat transfer, electric machinery, and applied thermodynamics were also made a part of the fourth year.

The proposed curriculum has 174 semester credit hours which represents a decrease of 30 hours. The laboratories are combined with their course lectures for more effective use and the shop work is significantly decreased and combined with courses in manufacturing processes. Laboratory sessions in subjects where there exists no equipment at the Center can be held as problems sessions where the students work practical engineering problems during the session or work on equipment to ultimately be a part of the lab.

The semester credit hours of laboratory work in the proposed curriculum is 25 which represents a total of 79 hours per week. This represents a 47% decrease in the number of lab credit hours. Cne hour of semester credit was assigned to a lab of 3 or 4 hours per week attendance so the decrease in number of lab hours per week is not proportionate to the decrease in credit hours.

These curriculum changes would not burden the teaching loads of the engineering faculty and will decrease the hours of contact the student has with the technology level labs. They will also encourage the development and use of practical engineering level laboratories.

Course Outlines - Existing Curriculum

The faculty of the School of Mechanical Engineering by the end of the 1968 year had completed a booklet outlining the subjects covered in the major mechanical engineering courses. The outlines give an indication of the thinking of the faculty towards the necessary requirements in the various courses. It is difficult to analyze accurately the actual coverage of each course as these change from class to class and with each faculty member. Difficulties in language, inaccessibility of instructional materials such as textbooks and limited reproducing facilities all contribute to a lower level of coverage.

The translation of these course outlines is shown in Appendix B. Technical concepts to date have been difficult to express in the Vietnamese language. The professors, by lecturing in Vietnamese, are trail blazers and acquire a self training in transposing the technical concepts into their own language. The difficulty of inconsistency must be realized. The translation into English of the course outlines may reflect some of these inconsistencies.

Physical Facilities

The primary facility of the School of Mechanical Engineering is the physical facilities building which covers more than 6,000 square meters and includes the following shops and laboratories:

1. Complete machine shop with tools and supplies
2. Foundry shop
   a. Ferrous
   b. Non-ferrous
3. Sand laboratory
4. Wood working and pattern shop
5. Forging shop
6. Heat treatment shop
7. Welding shop
   a. Gas
   b. Electric
8. Metallurgy laboratory with dark room
9. Chemical analysis laboratory for metals
10. Strength of materials laboratory
11. Sheet metal shop
12. Engine laboratory
    a. IC engine performance lab
    b. IC engine instruction and display lab
13. Diesel fuel-pump testing lab
14. Air condition and refrigeration lab - space plus excess property only

15. Thermodynamics laboratory - steam lab - space allocated only
16. Miscellaneous
    a. Blue printing room
    b. Two drawing rooms
    c. Auto mechanics area - junk cars only - unused
    d. Diesel generator room
    e. Large students room
    f. 3 offices

This facility was established by a joint effort between the Governments of South Vietnam and France. The building was constructed with funds from the GVN's National Budget and the equipment was provided by "aide Technique et Economie Francaise". Construction began late in 1959 and was completed by the end of 1960. The equipment was installed during the following three years. The building is of concrete construction with large concrete beams providing a long high structure. Space inside the building is poorly utilized and the equipment is oriented more towards the training of technicians than engineers. For a view of the exterior of this facility see Figure 2 . Each facility is described in the following sections and the areas are listed in Table 8.

Laboratory and Shop Descriptions and Equipment

Metallurgy Laboratory

The metallurgy laboratory, 34 m^2, is located on the mezzanine in the physical center. As shown in Figure 3 tile bench tops run

TABLE 8

LABORATORY AND SHOP AREAS

Laboratory and Shop Areas	Area Square Meter	Area Square Feet
Pattern Shop	365	3930
End Room	178	1920
Non-ferrous foundry	208	2240
Ferrous foundry	640	6880
Sand laboratory	33	356
Machine shop	874	9400
Stock and tool bin	200	2150
Air conditioning and refrigeration room	102	1100
Strength of materials laboratory	91.5	985
Engine laboratory	242	2610
Metallurgy laboratory	33.7	362
Chemical analysis laboratory (metals)	33	356
Dark room	6.7	72
Fuel pump laboratory	13.6	146
Diesel-generator-transformer room 400 KUA	117	1260
Blue printing room	102	1100
3 offices	101.1	1086
Welding shop	109	1170
Forging and heat treatment shop	140	1510
Sheet metal shop	313	3360
Steam laboratory space	135	1450

along two walls of the room and tables are stationed at the others. The lab is poorly equipped and equipped primarily for surface photometric work. A dark room is connected to this lab.

Equipment:

2 Nachet incident beam microscopes
3 Hyprey surface polishers 5 - 6"
1 Pyrection KT temperature controlled oven - 1200^{o}c
1 dilatometer

Dark Room:

Supply of chemicals
Supply of film
1 Durst U7 - enlarger
Film switching drawer
"Volomat" drawer for film 35 mm

Chemical Laboratory for Metals

This laboratory, a room of 50 m^2, is located next to the metallurgy laboratory on the mezzanine and has tile benches along two walls. There is a tile sink and a door connecting the lab with the metallurgy laboratory. Figure 4 shows this lab.

Equipment:

Precision balances
Vacuum ovens
Chemicals

Pattern and Woodworking Shop

A large room, 365 m^2, on the main floor houses the woodworking and pattern shop. The equipment is poor but adequate for rough woodworking and pattern making. A forced air, chip removal system is under the floor which carries the dust directly from the work piece on the machine. A large room, 178 m^2, at the end of the pattern shop is not utilized.

Equipment:

Surface planer
Finishing surface planer
Band saw and blade repair unit
15" circular saw
Disk sander
Belt sander
Wood lathe
Several jig saws
Wood drying oven
Gluing table
14 work benches

Sand Laboratory

The sand laboratory, a support lab for the foundry occupies one end of the foundry and is used to determine and control the quality of the sand used in the foundry. The lab seems adequately equipped for its specialized function. See Figure 5.

Equipment:

Shaker and seeves
Water content analyzer
Cil and Water content oven
Voltile matter oven
Permeability analyzer
Shear and compression testor
Vacuum oven
Scale
Sample presses

Foundry Shop

Well equipped ferrous and non-ferrous foundry shops occupy about 20% of the space in the building. Iron, aluminum and copper are the main metals used in these shops. Common to both is the equipment for sand and mold preparation. Figures 6 & 8 show the expanse of this facility.

Equipment:

Sand and mold processing
Large sand blender (Figure 5)
Sand pit
2 mold drying oven
2 mold presses
Cast preparation facilities
Casting ladle reheater

Ferrous

2 cupolas - cast iron furnaces
1 mechanical metal cleaner
Air sand blast cleaner
Several large stone wheel grinders

Non Ferrous

3 blower, burner furnaces 1200 - 1500 ^{o}c
2 small electric ovens - 1200 ^{o}c

Machine Shop

A well equipped machine shop covers approximately 874 square meters of the physical center. The machines and tools are all metric and replacement of tools from excess property is impossible. Figures show the equipment in the shop as well as the massive concrete beams of the building structure.

Equipment:

2 wheel grinders
7 vertical drill presses
1 GSP large radial drilling machine
3 two foot hand presses, mechanical
9 Homienne shapers - three sizes, three each
1 Line large planer, approximately 1.6x0.5 meter bed
4 H. Ernault Somua type HN 500 lathe 25 cm chuck
1 Titan 30 cm chuck with 1.3 meter bed
1 Somva N213 saddle turret lathe (small)
2 Ramo 20 cm chuck lathes
3 De Valliere 15 cm chuck lathes
1 cylindrical surface grinder, Gendron
2 eleven cm wheel flat-surface grinders
1 thirty cm wheel flat-surface grinder
1 large wheel Microrex precision surface grinder
4 H. Ernault Somua Vertical milling machines with swival head, 1x0.2 meter bed
4 Alcera column and knee horizontal spindal milling machines
(no band saw or power hack saw)

Special Maching Area, 645 m^2

Equipment:

2 small flat surface grinders
1 horizontal shaper
1 bidirectional bed drill press, medium duty
1 30 cm chuck lathe
2 wheel grinders
several small electric coil ovens

Strength of Materials Laboratory

A recently constructed building is to be equipped by UNESCC with material testing equipment. The space in the physical center presently used for a strength of materials laboratory will be made available for other use. UNESCC's equipment will certainly provide over extended capability over the present limited equipment.

Equipment:

Tensile testor - 30 metric tons, no extensometer
CRC oscilloscope - out of order
Resilence analyzer
Dynamic balancer
Hardness testor
Brinell
Rockwell
Elastometer
Fatigue testor

Internal Combustion Engine Laboratory

An engine lab occupying 242 square meters serves a dual purpose:

mechanical characteristics and dynamic characterisitcs. There are numerous IC engines which are used for mechanical instruction and display. Although familarity with the mechanisms enhances an engineers depth, IC engine performance characteristics such as specific fuel consumption, brake horsepower and mean effective pressure as functions of RPM are more important to the engineers. This lab has one test stand for studying the dynamic performance of an IC engine. A water brake is used as power load and an electric motor or a battery powered starting motor are provided for starting.

Adjacent to this lab is a large diesel engine which drives a 400 KVA alternator for use when the transfer power station loses power.

Equipment:

IC engine dynamic test system with water break and starting motors
Engine test stand and instruments
Various IC engines for dismantling
Diesel cutaway
Battery charger
Diesel fuel pump testing apparatus - occupies a room of 13.6 square meters adjacent to the engine lab

Sheet Metal Shop

The working of sheet metal into useful forms such as duct work and form work is possible in a 3360 square meter shop equipped with the following equipment:

Numerous sheet metal anvils
Disk cutter
Angle cutter
Hand shear
Peddle shear 4 mm thickness limit
Crimping rolls
Punch

Welding Shop

The welding shop is small covering 1170 square feet and has no exhaust system. This in part may be due to the open convection ventilation of the building's structure. There is a gas welding shop adjacent to an arc welding shop.

Gas Welding Equipment:

8 oxygen-acetylene units
Hoods and tables with hand tools

Arc Welding Equipment

3 arc welders with booths
1 spot welder (out of order)

Forging and Heat Treatment

The forging and heat treatment shop occupies 1510 square feet and is adjacent to the welding and sheet metal shops. Equipment is limited but definitely adequate for any engineering instruction.

Equipment:

1 giant forging press
1 mechanical forging hammer
2 forging furnaces
1 standard anvil
several furnaces and cooling baths

Laboratory Development

What are the goals of engineering education in Vietnam? In the U.S. engineering education must be geared to train professionals capable of meeting the technical requirements of an advanced technological society and equally important to advance that technology. The professional must gain from his education the qualities of creativity, adaptivity, and productivity as well as a competent capability in the fundamentals of his profession. In this latter respect the needs of Vietnam are no different. Engineers in Vietnam will be facing a diversity of challenges to satisfy not only the technical requirements of developing industry within Vietnam but also to satisfy the engineering requirements of complex industrial processes, imported from abroad, using advanced engineering techniques developed in other countries.

In a country such as Vietnam much of the initial push in industrial development comes from a source of engineering external to the country. This comes in the form of the technology which accompanies the installation of complex manufacturing processes, refineries, and many types of equipment and procedures of a foreign origin. Perhaps the largest number of engineers will be needed to operate and maintain this equipment.

It will be necessary for the engineers in Vietnam to be trained in practical technology but more particularly, he must also have the capability of design to improvise his equipment since there will evolve from this foreign input the necessity to change machinery, make new machines locally in the plants, and provide many broader functions than normally found in a plant in other countries. Much of this is necessitated by the extremely long shipping times for procurement and the lack of an extended manufacturing base in country which would provide many of the items needed for plant operation and maintenance. Consequently, the engineer in Vietnam must be provided not only experience at the shop level, but practical experience with sound engineering fundamentals in the laboratory. The establishment of these engineering laboratories which develop practical engineering ability is a pressing need in engineering education in Vietnam.

Many of the fundamentals which are important in engineering and which need to be emphasized in the laboratory can be summarized in the following general areas:

I. Instrumentation and Measurement
II. Fluid Mechanics
III. Heat Transfer
IV. Vibrations
V. Systems & Design-Control, Energy or Mechanical

The establishment of laboratory apparatus, not necessarily complex, in these areas will be most beneficial to students in their search for understanding the fundamentals covered in the classroom.

There are two approaches which can be successful in developing laboratory apparatus. The first is to divide the fourth year students into groups and under faculty supervision have them design and develop apparatus for their design projects. The second is to have the third year students at the beginning of the second semester, start their designs and material specifications so they can follow through with the development work their fourth year. This will be particularly helpful due to some of the procedures which are outlined below.

Equipment needs for the projects will have to be reviewed by the faculty supervisor and myself as early as possible to enable procurement as quickly as possible. Purchases have to be made in the U. S. from our campus and bids must be obtained before an order is placed.

Then the delivery time will also add to the procurement time. Thus if the third year students are involved, the next year's equipment needs can be processed and receipt accomplished much earlier.

Big pieces of equipment which are expensive take more time and the budget we have will have to be used for smaller items. Military equipment will be available on a random lucky basis but can be of great assistance in these projects.

Suggested staging:

1. Division of groups and faculty advisors;
2. Selection of project;
3. Primary equipment needs established very quickly;
4. Secondary needs following detailed design work;
5. Development and establishment of apparatus.

The previous laboratory development procedure was proposed to the Mechanical Engineering faculty and is being instituted presently for the fall semester 1970. Ten groups will be formed and supervised by the school faculty. In this way, the primary responsibility for developing laboratory experiments rests with the Vietnamese faculty members. The ME-UMR advisor will supervise one or two groups and will co-ordinate the activities of the other groups as to equipment selections and requisitions.

This program is being initiated as a continuing program and if successful will contribute much in the way of experimental capability for the school.

Enrollment

The Engineering Schools at the National Technical Center have been given instruction from the Ministry of Education to increase enrollment. Although no projections had been established, over the past few years the enrollment has been steadily increasing as Table 9 indicates.

TABLE 9

Mechanical Engineering Enrollment

	1st	2nd	3rd	4th	Total
64/65	26	24	20	16	86
65/66	25	26	24	22	97
66/67	30	25	26	24	105
67/68	35	30	25	25	115
68/69	46	33	27	25	131
69/70	50	45	31	27	153

Between 1964 and 1969 the total ME enrollment increased from 86 to 153 which amounts to an increase of 78%. During this same time the first year enrollment increased from 26 to 50 or doubled over the period. The 1970 first year ME enrollment will be 50 students. This will give a total enrollment of 176 or a 15% increase over the previous year.

The classes are still handled as a unit. There are no multiple sections so each course has the full class enrollment in attendance. Class sizes are at the point where multiple sections will have to be formed. This will increase the number of faculty members needed, but will allow a continued growth within the multiple sections. If the first year enrollment is held constant over a three year period, the total ME enrollment will grow from the projected 176 to 200 as the smaller upper level classes graduate. This would represent a 31% increase in the school enrollment merely by holding the first year enrollment constant for three years. However on a long range basis it would be unwise to do so.

In 1969 approximately 776 students applied for admittance and 51 were admitted. The 1971 first year class will seat 50 students and 1000 applicants are expected.

The major mechanical engineering classes are held in the building shown in Figure 11.

Discussion

The future of the School of Mechanical Engineering is certainly dependent upon the willingness of the Ministry of Education to sponsor long range planning, programming, and development. In this light, it is helpful to look at a brief background of the development of the National Technical Center to help understand the situation which presently exists. The following table highlights the origin of the programs at Phu Tho.

TABLE 10

Starting Dates for Engineering Schools

School of Engineering	Technician Training Started	First Engineering Graduates
Civil	1947*	1954*
Mechanical	1956**	1960**
Electrical	1947***	1961
Chemical	1963	1971 +

*Transferred from Hanoi. The first class of engineers to graduate were three year technician graduates given a fourth year and granted the Ky Su Degree.

**May have started as three year technician program and the fourth year added as in Civil Engineering. Information unavailable.

***Radio Technicians

+Third year class started in 1969 with School of Science graduates. First class to graduate in 1971.

In 1957 with only civil technician and engineering, electrical technician, and mechanical technician programs along with the School for Marine Navigation (technician), the National Technical Center was formed. That same year the Ky Su program in EE was started and mechanical switched to an engineering program. Twelve years later chemical engineering was initiated.

The last 15 years, 1956 - 1970, have seen engineering education established in these four areas and it cannot be said that the Vietnamese government has not supported this program with physical facilities. Although various aid agencies have contributed equipment, the GVN has supported an extensive construction program to house this equipment and provide classroom space. Sustaining the educational effort and the maintaining of facilities, unfortunately, has been suppressed by the policies and administrative structure tying the Center directly to the Government and by the anchor on salaries held by the civil service regulations of the Ministry of Interior. No hope for significant progress exists until education here is freed from this anchor.

The Ministry of Education, USAID, and the UMR advisors mutually agree that the major responsibility for planning the development of engineering education rests with the NTC engineering faculty. Instructions pertaining to this matter have finally been issued by the Ministry to the faculty. However, to date the service of the faculty to the Center has been mainly along academic lines and work of this nature is considered extra curricular. The low salary level and the necessity for the faculty to be employed elsewhere for the major portion of their annual income are responsible for this situation. It may be necessary to subsidize this planning effort with piasters. Even a proposal such as this has its disadvantages. The time schedules of the faculty in their academic and industrial jobs are established and a "temporary" program such as this will only be squeezed between these schedules. These are the unfortunate yet important realities which must be dealt with in pursuing a program such as this one.

One half of the professional level ME faculty have been or are being trained under the USAID participant training program and two others have been to English speaking countries for their degrees. Thus, two-thirds of the faculty in the school are proficient in English and have been exposed to Western educational institutions and technology. Consequently, there is a readiness among the faculty to improve the curriculum, develop more laboratory facilities and provide quality instruction to the students. Enrollments have increased and the ME curriculum reflects the background of Westernized training, yet has been geared to a degree towards a more practical level. The availability of shop equipment has led to too much shop work in the curriculum, thus filling in where engineering laboratory training should be.

Laboratory work in the Mechanical Engineering curriculum is primarily shop work. There is basically no equipment to acquaint the student with the principles of heat transfer, fluid mechanics, thermodynamics, mechanics, dynamics, kinematics, vibrations, fluid machinery, etc. It is inconsistent to declare that a student need to be trained in engineering fundamentals such as these and not provide a means for him to gain the necessary practical experience. Unfortunately, to date, practical experience as applied to educate mechanical engineers refers to shop work. Since industrial on-the-job training for engineering graduates is limited and there exists a need for the trained engineers, emphasis must be directed in the engineering schools towards providing to a degree sufficient technical experience.

The lack of money both for salaries and equipment has prevented the development of laboratory apparatus at the engineering level. Faculty efforts are devoted primarily towards teaching and little else in their academic jobs. What equipment there is at the site has been the result of aid programs. There is little evidence of apparatus which has been developed under the direction of the Vietnamese faculty. UNESCC is working towards providing a laboratory equipped with steam and power producing equipment. The GVN has agreed to provide a building for this equipment. The faculty are assisting with the architectural specifications and design but the technology is being provided by UNESCC.

In order to provide the school with apparatus for teaching engineering fundamentals, a laboratory development program suggested by the author has been established. Each faculty member will direct a group of students with the design and development of laboratory apparatus. The USAID advisor will supervise one or two projects as well as coordinate the acquisitions for the other projects. By following this procedure, the major development role is being provided by the faculty and students.

The ME school, as do all the others, operates independently.

The Director is responsible for his School and decides how his space is to be utilized. Courses and teaching schedules are scheduled by the Director after conferring with the faculty so classes can be scheduled around the faculty's off-campus committments. Due to scheduling difficulties, a 3 hour course may end up being a 2-1/2 hour course. Major programs such as the in-house production program must be cleared through the Ministry but once cleared, they become the responsibility of the School. There is a need to unite the schools and this has the attention of the Ministry. Yet to do so will require additional administrative positions at the Center level.

The educational process at the Center is one where the students are exposed to a subject primarily through lectures. Theory is taught but not utilized at practical levels by working problems. One exam is given at the end of the school year for each subject. The grade of each exam is normalized with a perfect score being 20. A weighting factor is applied depending on the importance of the subject and the grade for the year's work is determined as follows:

$$G = \frac{\sum G_i W_i}{\sum W_i}$$

where

G_i = normalized grade in course i.

W_i = weighting factor (1, 2, 3, etc.) for course i.

G = grade for year's work

i = course of first year, second year, etc.

Satisfactory completion of the year's work requires a grade of 10 or above. Students failing to meet this minimum must repeat the entire year.

Observations, Conclusions, and Recommendations

1. The faculty need to be given professional status and salaries competitive with industry. This would require removing education from the bonds of civil service.

2. Faculty members should be encouraged to consult and become acquainted in industrial circles but should keep these activities from occupying more than about 20% of their time.

3. Approximately 204 credit hours are required for the "Ky Su"

degree in Mechanical Engineering. The curriculum covers a broad spectrum of courses which should be narrowed somewhat. By combining courses and coordinating courses and labs, about 30 credit hours can be eliminated. The new 1970-71 ME curriculum reflects a movement in this direction.

4. Due to the lack of engineering laboratory equipment, the curriculum has an over abundance of shop work. Through a laboratory development program and use of lab sessions for practical problem solving, a better understanding of engineering principles can be administered to the students. This development would bring about the badly needed shift from shop work to lab work.

5. Over the past 6 years enrollment has increased from 88 to 153 for an increase of 74%. The 1970-71 enrollment will be about 176 with the class sizes being limited to 50 students. Multi-sections do not exist and any further increase in enrollment will require splitting the classes into double sections and hiring additional faculty. However, for the first two years, only increases in Center level faculty would be required.

6. Instructional materials are not readily available to the faculty or students. The development of lecture notes and textbooks in Vietnamese should be encouraged and supported and cheap, rapid, and reliable reproducing facilities made available to encourage the distribution of materials.

7. Every effort should and will be made to meet the deadline, May 1, 1971, for completing the master plan. This planning will be directed by the Ministry of Education through the Center down to the School.

8. A consistent degree requirement should be required for all the schools with a core curriculum taught by Center level faculty. If at all possible the curriculum should be outlined so higher educational institutions can evaluate it for the purpose of accepting students for graduate work.

9. A participant program should include top level National Technical Center graduates who are hired by the Center as faculty and sent abroad for graduate training.

A P P E N D I X A

TEACHING ROSTER, 1969 - 1970

SCHOOL OF MECHANICAL ENGINEERING

Teaching Roster 1969 - 1970, First Year

Number	Course Description	First Semester Hrs/Wk-Lec/Lab	First Semester Professor	Second Semester Hrs/Wk-Lect/Lab.	Second Semester Professor
101	Mfg. Processes & Materials	3	Vu Trong Khoi	3	Vu Trong Khoi
102A	Industrial Drawing	3	Van Dinh Vinh	3	Van Dinh Vinh
102B	Industrial Drawing	4	Nguyen Khanh Van	4	Nguyen Thanh Tong
104	Algebra	2	Nguyen Trong Ba	2	Nguyen Trong Ba
105	Analytical Geometry	-	-	2	Nguyen Trong Ba
106	Calculus	3	Vo The Hao	2	Vo The Hao
107A	Mechanics & Sound	3	Le Manh Hung	-	-
107B	Thermodynamics	-	-	3	Nguyen Quang Van
107C	Electricity	3	Vo Duc Dien	3	Vo Duc Dien
107D	Physics Lab	3	Nguyen Anh Dung	3	Nguyen Anh Dung
108A	Inorganic Chemistry	3	Duong Hai Duong	-	-
108B	Chemistry Lab	3	Le Vu Cuong	-	-

Number	Course Description	First Semester Hrs./Wk.	First Semester Professor	Second Semester Hrs./Wk.	Second Semester Professor
114	French	3	Jean Portay	1	Jean Portay
115	English	-	-	3	Tran My Van
116	Economics	-	-	2	Chau Tam Luan
118	Physical Education	2	Nguyen Tri Tin	1	Nguyen Tri Tin

SCHOOL OF MECHANICAL ENGINEERING

Teaching Roster 1969 - 1970, Second Year

Number	Course Description	First Semester Hrs./Wk.	First Semester Professor	Second Semester Hrs./Wk.	Second Semester Professor
201	Mfg. Processes & Materials	3	Tran The Can	3	Tran The Can
202	Industrial Drawing	3	Nguyen Nang Cuong	3	Nguyen Nang Cuong
204	Calculus	3	Luu Huu Dung	4	Luu Huu Dung
205	General Mechanics	2	Nguyen Don Phu	2	Le Manh Hung
208	Thermodynamics	3	Nguyen Quang Van	-	-
209	Optics	-	-	3	Phung Van Bo
210	Electricity	2	Nguyen Huu Minh	2	Nguyen Huu Minh
212	Physics Lab	3	Nguyen Anh Dung	3	Vo Due Dien
213	Chemical Physics	-	-	3	Nguyen Kim Hien
214	French	-	-	3	Jean Portay
215	English	3	Khuong Hung Chan	-	-
216	Strength of Materials	2	Nguyen Don Phu	2	Nguyen Don Phu
218	Physical Education	2	Nguyen Tri Tin	1	Nguyen Tri Tin

SCHOOL OF MECHANICAL ENGINEERING

Teaching Roster 1969 - 1970, Third Year

Number	Course Description	First Semester Hrs/Wk-Lec/Lab	First Semester Professor	First Semester Hrs/Wk-Lect/Lab	First Semester Professor
301	Structural Design - Metal	-	-	1/2	Nguyen Don Phu
302	Structural Design-Concrete	-	-	1/2	Nguyen Don Phu
303	Heat Engines	1/2	D. Soubiron	-	-
305	Pattern & Mold	3/4	P. Granottier	2	Paul Granottier
306	Mechanical Vibrations	3	Le Manh Hung	-	-
307	Fluid Mechanics	2	Le Manh Hung	2	Le Manh Hung
308	Heat Transfer	-	-	2	Nguyen Quang Van
309	Materials Testing	2/2.25	Nguyen Don Phu	-	-
310	Metallurgy	3/4.5	Nguyen Khanh Van	-	-
311	Electric Machinery	6.5	Nguyen Han Ty	5.5	Nguyen Han Ty & Duoc
312	Air Conditioning & Refrigeration	-	-	2	Nguyen Nhu Bien
314	Work Organization	-	-	2	Lam To Bong
315	Commercial and Labor Law	2	Nguyen Van Ngan	2	Nguyen Van Ngan

		First Semester		Second Semester	
Number	Course Description	Hrs/Wk-Lec/Lab	Professor	Hrs/Wk-Lect/Lab	Professor
316	Economics	-	-	2	Chan Lam Luan
317	Field Trip	NC	Nguyen Quang Van	-	-
318	Technical English	3	Nguyen Hoang Sang	-	-
320	Professional Guidance	NC	Nguyen Quang Van	-	-
321	Physical Education	2	Nguyen Tri Tin	1	Nguyen Tri Tin

SCHOOL OF MECHANICAL ENGINEERING

Teaching Roster 1969 - 1970, Fourth Year

		First Semester		Second Semester	
Number	Course Description	Hrs/Wk-Lec/Lab	Professor	Hrs/Wk-Lect/Lab	Professor
400	Material Handling	-	-	3	A. Descoust
401	Fluid Machinery	-	-	3	Nguyen Hoang Sang
402	Steam Production & Utilization	-	-	3/2	D. Soubiron
403	Heats Engines	3/4	Do Ngoc Canh	0/1	Do Ngoc Canh
404	Machine Design	2/2	Vu Trong Khoi	-	-
405	Foundry	3/8	Paul Granottier	2	Paul Granottier
406	Heat Treatment	2/2	Nguyen Khanh Van	-	-
407	Forging, Welding, Molding	3/4	Van Dinh Vinh	0/4	-
408	Accounting	-	-	3	Bui Tien Hoang
418	Technical English	3	Nguyen Hoang Sang	-	-
420	Professional Guidance	NC	Nguyen Quang Van	-	-

Number	Course Description	First Semester Hrs/Wk-Lec/Lab	First Semester Professor	Second Semester Hrs/Wk-Lect/Lab	Second Semester Professor
421	Phsical Education	2	Nguyen Tri Tin	1	Nguyen Tri Tin
431	Naval Architecture & Construction	-	-	4	Le Manh Hung
432	Power Plants	-	-	4	Bui Van Nghiem
434	Refrigeration	2	Nguyen Nhu Bien	2	Nguyen Nhu Bien
435	Fuel Technology	-	-	3	Đo Ngoc Canh
444	Electric Machinery	-	-	2	Nguyen Han Ty
446	Computer Programming	-	-	2	Nguyen Trong Ba

A P P E N D I X B

TRANSLATION OF MECHANICAL ENGINEERING SYLLABI

301 (16 - 32) Technology of Construction:
METALLIC CONSTRUCTION

General:

Materials and the use of materials. Con tán. Soldering (welding). Molding. Applications for columns, beams, staircases, levels, roofs, floors and so on.

This subject is part of Technology of Construction for the Third Year. It must show the students how to calculate the commercial metallic constructions sold at the market such as steel plates and steel sections.

Content

Theory

1. Materials and the use of materials
2. Con tán
3. Soldering (or welding)
4. Molding

Practice

Design: Columns, Beams, Bridges, Staircases, Floors, Roofs ...

302 (16 - 32) Technology of Construction:

WOODEN CONSTRUCTION

General:

Qualities and general conditions of the use of wood strength. Joints in wooden construction. Other kinds of construction.

Content:

1. Qualities and General Conditions of use:

   1-1 General characteristics

   1-2 Kinds of tree and wood cutting.

   1-3 Spoiled spots and changes

   1-4 General rules of the use

   1-5 Tree classification

2. Wood Strength

   2-1 Aspirations and apparent forces

   2-2 Cases suitable for experiments

   2-3 Cases unsuitable for experiments on wood rupture

   2-4 Effects of moisture

   2-5 Special aspirations

3. Fittings in wooden constructions:

   3-1 General

   3-2 Fittings of planks of parallel axes or of coinciding axes

      3.2-1- Depths of common planks

      3.2-2- Fittings of double planks

      3.2.2-1 Planks under tension or compression

      3.2.2-2 Planks under bending forces

3.2.2-3 Planks under torsion

3-3 Fittings for planks having intersecting axes

4. Other constructions:

4-1 Floors

4-2 Wooden partitions

4-3 Roofs

4.3-1- Half cross section

4.3-2- Foot of cross-rafter

4.3-3- Cross beams

4.3-4- Pre-fabricated roofs

4-4 Frame making (làm gióng)

303 (16 - 32) REINFORCED CONCRETE CONSTRUCTION

General:

General idea about reinforced concrete, calculations and realization of columns and beams. Fundamental principles of pre-fabricated reinforced concrete.

Content:

Theory

1. General

   1-1 Principles

   1-2 Advantages

   1-3 Rules

   1-4 Notation

2. Allowable Internal Stresses.

   2-1 Reinforcing steel

   2-2 Concrete

   2-3 Reinforced concrete mixture

3. Calculations of Internal Stresses, Cross-sections of beams and columns.

   3-1 Principles, assumptions, value of assumptions

   3-2 Columns

      3.2-1- Estimation of compressive force

      3.2-2- Steel frame

      3.2-3- Stress testing

      3.2-4- Bands (Vòng đai)

      3.2-5- Curving pressure (Ép cong)

3-3 Beams

3.3-1- General

3.3-2- Calculation of bending momen and shearing force

3.3-3- Bands (Vòng đai)

3.3-4- Internal Stresses in beams of T section (size known)

3.3-5- Size of section T (external force known)

3.3-6- Use of function curves

3.3-7- Steel frame location

3.3-8- Strength of shearing force

4. Fundamental principles of pre-fabricated concrete

Practice

Students try to make some simple designs of columns and beams to know how to use reinforced concrete at its utmost.

304 (16 - 32) Technology of Construction

HANDLING EQUIPMENTS

General:

Uses and effects of handling equipments; principal machines; important handling equipments; cai kich, hoists and hoisters, forklifts, cantilevered truss, elevators, cable equipments derricks and cranes.

Content:

1. General

   1-1 Uses and effects of handling equipments

   1-2 Mechanical characteristics

   1-3 Motives

   1-4 Theoritical calculations of mechanical characteristics

2. Principal mechanisms of handling equipments.

   2-1 Mechanisms relating to the lifting of goods

   2-2 Driving mechanism

   2-3 Speed reduction mechanism

   2-4 Safety mechanism

3. Cai Kich, Jack

   3-1 General

   3-2 Cai Kich

   3-3 The jack

4. Hoist and hoister

   4-1 General

   4-2 Common hoists

4-3 Screw Hoist

4-4 Geared hoist

4-5 Hoist mount

4-6 Hoister

5. Forklifts

5-1 General

5-2 Forklift frame

5-3 Forklift guide

5-4 Forklift lifting mechanism

5-5 Forklift truck

5-6 Forklift frame

6. Cantilevered Truss

6-1 General

6-2 Fixed cantilevered truss

6-3 Moving cantilevered truss

6-4 Cantilevered truss on moving

6-5 Railway cantilevered truss

6-6 Cantilevered truss on frame

6-7 Cantilevered truss on vehicle

6-8 Special cantilevered truss

6-9 Calculations

7. Common Elevators and Merchandise Elevators

7-1 General

7-2 Common elevators

7-3 Merchandise elevators

7-4 "Slips"

8. Equipments moving in air by cables

8-1 General

8-2 Machinery

8-3 Two-cabled equipments

8-4 One-cabled equipments

8-5 Truck for the two-cabled equipments

8-6 Rail-cable equipment

9. Derricks and Cranes

9-1 Crane (derrick) cantilever

9-2 Continuous conveyors

9-3 May muc nang loai co mam

9-4 Archimedes screw

9-5 Continuous pipe moving machine

9-6 Vibrating material handlers

9-7 Pneumatic materials handling equipment

305 (48 - 64) PATTERN MAKING

General:

First year: general knowledge

Second year: general knowledge of wood used in industry.

Third year: Detailed wood applications in industry and in foundry in particular

Students will be shown how to design patterns in different ways.

Content:

1. Introduction

2. Pattern

    2-1 Definition

    2-2 Design study

    2-3 Methods of making molds

    2-4 Details of pattern making

3. Kinds of patterns.

    3-1 According to forms and applications

    3-2 According to materials

4. Study of wooden patterns

5. Study of plaque models

    5-1 General idea

    5-2 Characteristics

    5-3 Classification

    5-4 Common methods of fabrication

6. Pattern examination

7. Foundry organization

8. Costs and prices

9. Conclusion

306 (46 - 00) MECHANICAL VIBRATIONS

General:

Vibrations of mechanical systems. Linear differential equation of second order. Fourier's series. Natural vibration, first order with or without priction. Balance of rotating parts of machines. Unbalanced mass on an elastic axis. Non-periodical compulsory force. To-and-fro vibration. Vibration measuring equipments: tương đương động cơ, systems of second ordered free vibration, natural vibration and forced vibration. dynamic absorber. Concept of free, multiordered vibration. Concept of wave phenomenon. Concept of controlling system.

Content

1. General

   1-1 Concept of vibration

   1-2 Second ordered homogeneous linear differential equation

   $$M \frac{d2\,x}{dt2} + K\,x = 0 \text{ and } M \frac{d2\,x}{dt2} + C \frac{dx}{dt} + kx = 0$$

   1-3 Linear non homogeneous differential equation

   $$M \frac{d2\,x}{dt2} + Kx = f\,(+) \text{ and } M \frac{D2\,x}{dt2} + C \frac{dx}{dt} + kx = F(+)$$

   1-4 Harmonic motion $x = X \sin wt$ - Fresnel diagram

   1-5 Fourier's series

2. First Ordered Free Natural Vibration without friction

   2-1 Spring mass system

   2-2 Torsimal vibration

   2-3 Spring without brake - Small Transformation method

   2-4 Energy method

3. First ordered free Natural vibration with friction

   3-1 Kinds of friction: viscous friction, coulomb friction, friction cung.

   3-2 Độ tủ, energy loss at each cycle, the equivalent friction coefficient.

   3-3 Mass system - Spring

   3-4 Natural vibration with Coulomb friction

   3-5 Natural vibration with friction cung

   3-6 Negative friction - Unstability

4. Forced vibration

   4-1 Sinusoidal forced vibration

   4-2 Amplitude - Amplification factor

   4-3 Transmitting force - Isolation of vibrations

5. Balance of rotating parts

   5-1 Unbalanced rotating mass

   5-2 Static balance and dynamic balance

   5-3 Balancing machine

   5-4 Unbalanced mass on an elastic axes

   5-5 How to balance parts of a rotating machine on place

6. Forced vibration: Non-periodical compulsory force

   6-1 Non elastic collision

   6-2 Impulse

   6-3 To-and-fro vibration

7. Vibration Measument: Electrical - mechanical equivalence

   7-1 Electrical circuit: electrical resistance, self-inductance, capacitance, triode-Kirchoff's law.

7-2 Differentiation and integration by electrical circuit method.

7-3 Method of recording to-and-fro phenomenon

7-4 Seismometer - Cycle and amplitude measuring equipment

7-5 Harmonic analysis

8. Second-ordered free vibration system

8-1 Systems of second ordered free vibrations

8-2 Phương trình chuyển vận: hiện tượng phách, chấn động ghép.

8-3 General analysis of second ordered free vibration: method of orthogonalization.

8-4 Forced vibration

8-5 Dynamic absorber

8-6 Centrifugal pendulumn

8-7 Lanchester absorber

8-8 Method

9. Multi-ordered free vibration concept

9-1 General idea

9-2 Holzer's method

9-3 Influencing factor method

9-4 Method

10. Wave Concept

10-1 Wave moving in a horizontal bar

10-2 Wave equation

10-3 Dây đèn

11. Control System

    11-1 General idea about control system

    11-2 Servo-mechanism

    11-3 Feedback phenomenon

    11-4 Response lag: unstable phenomenon

    11-5 Governor: speed control.

307 (64 - 36) FLUID MECHANICS

General:

Concept of fluids - Fundamental principles, systems of units, hydrostatics: Equilibrium of a body in a fluid, pressure, manometer, fluid dynamics, longitudinal velocity, acceleration, law of conservation of mass: Continuity equation. Dynamics of fluid: energy equation, momentum equation, angular momentum equation. Ideal fluids Euler's equation and Bernonilli's equation. Dimensional analysis and similarity. Flows of a viscous fluid: laminar flow and turbulent flow. Flow in a pipe, flow over a weir. Concept of airplane wing theory and boundary layer theory.

Content

1. Fundamental concept of fluids.
   - 1-1 Definition of fluid
   - 1-2 Systems of Units
   - 1-3 Viscosity, coefficient of viscosity, Newton's viscous law
2. Hydrostatics
   - 2-1 Basic equations of hydrostatics
   - 2-2 Pressure: pressure measurement, manometer
   - 2-3 Forces acting on a body in a fluid. Archimede's principles. Pascal's principles.
   - 2-4 Floating bodies - Stable equilibrium and unstable equilibrium of a floating body.
3. Fluid Dynamics
   - 3-1 Definition. Streamline. Trajectory
   - 3-2 Fluid velocity. Normal velocity

3-3 Acceleration of a fluid particle

3-4 Law of Conservation of Mass. Continuity equation

4. Fluid Dynamics

4-1 Definition of a controlled system and controlled volume

4-2 Momentum equation

4-3 Use of momentum equation

5. Energy equation

5-1 First law of thermodynamics

5-2 Energy equation

5-3 Second law of thermodynamics

6. Angular momentum equations

6-1 Angular momentum equations

6-2 Applications

7. Ideal fluids

7-1 Euler's flow equation

7-2 Bernonilli's equation

7-3 Concept of airplane wing theory

7-4 Vorticity and lift

8. Dimensional analysis and Similarity

8-1 System of units

8-2 Homogeneous units in equations

8-3 Buckingham's law

8-4 Similarity

9. Flow of Viscous Fluids

9-1 Laminar flow and turbulent flow, Reynold's experiment

9-2 Reynolds number

9-3 Laminar flow - Nadier Stokes's equation

9-4 Flow in a pipe: friction loss

9-5 Flow over a weir

9-6 Boundary layer concept

308 (48,00) HEAT TRANSFER

Fundamental principles of heat transfer and their applications in the making of tools used in industry. Solving problems of heat transfer at the permanent and temporary states by analytical and graphical methods. Natural and forced convection phenomena. Transmission of radiative energy.

Content:

1. General

   1-1 General Observation

   1-2 Importance of heat transfer

   1-3 Principle modes of heat transfer

   1-4 Principal law of heat transfer

   1-5 Principal law of convection

   1-6 Principal law of radiation

   1-7 Dimensions and units

2. Heat transfer in one dimensional steady state

   2-1 Meaning of one dimensional heat transfer

   2-2 Plane walls having constant temperatures at both surfaces

   2-3 Adjacent plane walls

   2-4 Hollow cylinder having constant temperatures at both surfaces

   2-5 Adjacent cylindrical layers

   2-6 Boundary surface surrounded by fluid having constant temperature

   2-7 Temperature profile around a long pipe

   2-8 Total heat transfer coefficient

3. Extended surfaces

3-1 Preliminary observation

3-2 Straight wing having constant thickness - Long rods having constant cross sectional area.

3-3 Very long straight wing

3-4 Applications

3-5 Variation of sizes according to weights

3-6 Wing efficiency

4. Transfer according to two independent variables

4-1 Transfer at steady state in a rectangular plane

4-2 Transfer at steady state in a circular cylinder having fixed length.

4-3 Transfer at unsteady state (temporarily one dimensional)

4-4 Thick wall having periodical temperatures at one side

5. Heat transfer by convection

5-1 Forced convection - Methods of observation

5.1-1 Observations using differential equations about displacement and energy.

5.1-2 Reynold's theory of similarity

5.1-3 Dimensional analysis

5.1-4 Experimental rules

5-2 Natural convection

5.2-1 Equations governing natural convection

5.2-2 Experimental rules

5-3 Convection during boiling and condensation

6. Heat transfer by radiation

   6-1 Coefficients of absorption, reflection and penetration.

   6-2 Emission

   6-3 Radiosity - Irradiation

   6-4 Kirchoff's law

   6-5 Lambert's law

   6-6 Heat transfer between two large surfaces, between black surfaces and between grey surfaces.

   6-7 Heat transfer between two fixed surfaces - The shape factor.

7. Heat transfer by combined methods

   7-1 Total heat transfer coefficient

   7-2 Combination of conduction and convection

      7.2-1 Heat exchanger

         7.2-1.1 Paralled flow

         7.2-1.2 Counter flow measurement

         7.2-1.3 Cross flow

   7-3 Combination of conduction, convection and radiation - Water pipe in direct contact with the flame.

309 (32 - 36) STRENGTH OF MATERIAL

General:

Following the second year program: Calculation of bending according to Euler's theory and Dutheil's method. Varied uses of beams. Super-static system.

Study of continuous beams and frames. Practice of the second year theory program.

Content:

1. Bending
   - 1-1 General: definition and principles
   - 1-2 Euler's theory: assumptions, observation and development, conditions for application.
   - 1-3 Real conditions
   - 1-4 Rankine's formula
   - 1-5 Dutheil's method: theory, assumption, development and application
   - 1-6 Compare Euler, Rankine, Dutheil.
2. Deformations of beam
   - 2-1 Deformation equation
   - 2-2 Moment - Area method - Applications
   - 2-3 Coinciding deformation (Trung hop bien dang)
3. Superstatic system
   - 3-1 Phương phap trung hợp
   - 3-2 Three-moment theorem - Continuous beam
   - 3-3 "Pente-Deciation" equation
   - 3-4 Moment distribution (Hardy Cross's method)

Practice:

1. Straining experiment: Test Hooke's law, calculate elasticity rate, E (Young's modulus).
2. Bending experiment: Calculate elasticity E.
3. Bending pressure experiment: Test Euler's theory
4. Simple shear experiment
5. Hardness experiment according to Brinell and Rockwell
6. Material fatigue experiment.

310 (48 - 72) METALLURGY

General:

Metallurgical physics - Metal crystal structure various kinds of equilibrium charts for metal industries. Methods of production and metal refining. Heavy industries.

Practice on finding contents and distribution of cast iron and steel crystal structures.

Content:

Theory

1. Physical metallurgy

 1-1 Metal form

  1.1-1 Definition of metal crystal

  1.1-2 Inter lattice forces and method of joining metals

 1-2 Metal crystal structure

  1.2-1 Systems of metal crystals

  1.2-2 Concept of crystallography and crystal surfaces

  1.2-3 Analysis of crystal structures

  1.2-4 Crystalline constant and radii of metal nuclei

  1.2-5 Poly-crystalled metal and transformations of metal grains

  1.2-6 The incompleteness of metals in crystal forms.

 1-3 Alloy structures

  1.3-1 Structure of solid solution

  1.3-2 Structure of medium phases

1-4 Diffusion in metals and alloys

1.4-1 Fick's law

1.4-2 Laws of partical mobility in crystals

1-5 Phase Diagram of Alloy Balance

1.5-1 Phase Diagram of one-substance system

1.5-2 Phase diagram of a system having two substances mixed in a solid state.

1.5.2-1 Phase analysis

1.5.2-2 Analysis of the chemical composition of a phase

1.5.2-3 Estimation of mass of phases

1.5-3 Phase diagrams of two substances not mixed in a solid state - eutectic reaction.

1.5-4 Graphics of a system having two substances mixed partly in a solid state.

1.5.4-1 Dissolution effects

1.5.4-2 Peritectic reaction

1.5.4-3 Medium phase

1.5-5 Changes in the solid state

1.5-6 Equilibrium of metals and gases

1.5-7 Gibb's phase law

1.5-8 Ternary phase diagrams

1-6 Iron - Carbon Alloy

1.6-1 Phase diagrams of iron-carbon

1.6.1-1 Variations at nearly limited temperature

1.6.1-2 New structures resulted from Austenit's division

2. Industrial Metallurgy

2-1 Definition of ore

2-2 Rough metal production

2-3 Methods of metal refinery

2.3-1 Method of using heat without reaction

2.3-2 Method of using chosen reactions

2.3-3 Electrolysis method

2-4 Ore preparation

2.4-1 Preliminary mechanical methods

2.4-2 Division method

2.4-3 Chemical method

2.4-4 Magnet method

2.4-5 Heat method

2.4-6 Ore agglomeration

3. Cast iron, steel and heavy industries

3-1 General

3-2 Raw materials

3-3 Fundamental principles of the manufacturing

3.3-1 Iron - Oxigen system

3.3-2 Iron - Carbon system

3.3-3 Carbon - Oxigen system

3.3-4 Iron - Carbon - Oxigen system

3-4 Effects of materials going along with iron

3-5 Matrixes

3-6 Technology of cast-iron furnace

3.6-1 Form and size of the furnace

3.6-2 Production (out put) of the furnace

3-7 Steel production

3.7-1 General reactions in steel production

3.7-2 Methods of production

3.7.2-1 Besamer and Thomas Steel

3.7.2-2 Martin steel

3.7.2-3 Electric steel

3.7.2-4 Oxigen steel

Practice

1. Concept of chemical analysis
2. Calculation of the composition of steel and cast iron by chemical method.
   - 2-1 Calculation of the carbon rate
   - 2-2 Calculation of the mangan rate
   - 2-3 Calculation of the phosphor rate
   - 2-4 Calculation of the silicium
3. Calculation of the iron rate in iron ore
4. Calculation of the composition of brass alloy by electrolization
5. Measurement of the linear expansion of a metal pattern
6. Metallography
   - 6-1 Big-structure metals
   - 6-2 Small-structure metals

Note: The laboratory program depends on equipments and chemicals available in the labs.

311 (4t - 00) INDUSTRIAL ELECTRICITY

General:

Review of principal laws of electromagnet - Classification of electric machines. Theory of magnetic current. Direct current electric machine: Dynamo. Sinusoidal electric motors: transformers, alternators, synchronous motors, asynchronous motors, rectifiers. Maintenance.

Content:

1. General:

   1-1 Review of fundamental laws of electromagnetism

      1.1-1 Laplace's law of effect of a magnet on a string

      1.1-2 Biot Savart's law of magnetism caused by an electric current.

      1.1-3 Lenz's law of electromagnetism

   1-2 Classification of electrical machinery

      1.2-1 Main parts of electric machinery

      1.2-2 Classification of electric machinery based on their functions

      1.2-3 Classification of electric machinery based on the nature of electric currents.

   1-3 Theory of magnetic current

      1.3-1 Magnetic current

      1.3-2 Theory of magnetic current non-saturated

      1.3-3 Saturated magnetic current

      1.3-4 Hysteresis effect

2. Direct current machinery

2-1 Dynamo

2.1-1 Magnetic current

2.1-2 Conduction of brushes

2.1-3 Commutator

2.1-4 Winding

2.1-5 Production of commutation force

2.1-6 Reaction of brushes

2.1-7 Rectification

2.1-8 Characteristics of dynamo

2.1.8-1 Strength of a multi-connected dynamo

2.1.8-2 Application of different methods of stimulation

2.1.8-3 Conclusion

2-2 Direct current electrical motors

2.2-1 Theory

2.2.1-1 Direction of torque, direction of its rotation

2.2.1-2 Definition and expression of electromagnetic torque

2.2.1-3 Definition and expression of useful torque

2.2.1-4 Expression of speed

2.2-2 Characteristics

2.2.2-1 Common characteristics

2.2.2-2 Shunt motors

2.2.2-3 Series motors

2.2.2-4 Compound motors

2.2-3 Uses in industry

2.2.3-1 Starting engines

2.2.3-2 Speed rectification

2-3 Accessories of direct current electrical motors

2.3-1 Protective parts

2.3.1-1 Fuse

2.3.1-2 Plug

2.3.1-3 Alternator

2.3.1-4 Magnetic switch

2.3-2 Rheostat for starting engines and for stimulating direct current electrical motors.

2.3.2-1 Rheostat for starting engines

2.3.2-2 Rheostat for stimulating

2.3-3 Electromagnetic contact

2.3.3-1 Definition

2.3.3-2 Purpose

2.3.3-3 Control

2.3.3-4 Installation

2.3-4 Cutting of electricity

2-4 Shunt wound motors

2.4-1 Motors having supplementary ends of rectification of which speed changes accordingly at ratio from 1 to 2.

2.4-2 Motors having speed changing at ratio from 1 to 10.

2.4.2-1 Arrangement of motors with too much or too little saturation.

2.4.2-2 Leonard system

2.4.2-3 Application of change of electronic speed in direct current electrical engines.

2-5 Problems of direct-current electrical engines

2.5-1 In dynamo

2.5-2 In engines

2-6 Limits of radio waves broadcasted from engines

3. Sinusoidal electrical machinery

3-1 Variable transformer

3.1-1 Theory

3.1-2 Characteristics

3.1-3 Variable ratio

3.1-4 Ideal variable transformer

3.1-5 Practical variable transformer

3.1-6 Loss, Heating, Efficiency

3.1-7 Cam tuong variable transformer

3.1-8 Installation of variable transformers

3.1-9 Special variable transformers

3-2 Alternator

3.2-1 Theory

3.2-2 Description

3.2-3 Characteristics and experiments

3.2-4 Efficiency, heating, maximum power

3.2-5 Synchronous motors

3.2-6 Installation of synchronous motors

3-3 Asynchronous motors

3.3-1 Theory

3.3-2 Description

3.3-3 Torque

3.3-4 Direct coupling

3.3-5 Loss and efficiency

3.3-6 Changes of speed

3.3-7 Uses of asynchronous motors

3.3-8 Single phase asynchronous motors

3.3-9 Commutator

312 (33 - 00) FUNDAMENTAL REFRIGERATION INDUSTRY

General:

Fundamental factors in refrigeration industry - Refrigeration cycle: mechanisms of the air conditioning, refrigerants, refrigerant ton. Psychromechic chart. Method of calculating refrigerant capacity. Refrigeration systems. Industrial air-conditioning. Food conservation.

Content:

1. General
2. Fundamental factors
   - 2-1 Temperature
   - 2-2 Humidity
   - 2-3 Wind motion and distribution
   - 2-4 Air properties
3. Refrigeration Cycle

   Main parts of common air conditions electrical diagrams. Refrigerant ton.
4. Psychrometric chart
5. Method of calculating refrigeration requirements

   Fundamental and practical factors. Air ducts and the distribution of refrigeration systems.
6. Industrial air-conditioning and food conservation.

313 (48 - 60) DESIGN PROJECT

General:

Shop organization - Project study. How to select fabrication method - Design project analysis study problems and the required amount of time practice using printing machines in projects of building and furnishing for the school. Study production projects.

Contents

Theory

1. Shop organization

   1-1 General organization

   1.1-1 Concept of production

   1.1-2 Organization difficulties

   1.1-3 Setting criteria

   1.1-4 Labor factor: selection

   1.1-5 Labor factor: recruitment

   1.1-6 Labor factor: safety

   1-2 Administrative and commercial organization

   1.2-1 Administrative and commercial organization

   1.2-2 Cost and estimate

   1.2-3 Commercial organization

   1.2-4 Trading agencies

   1.2-5 Technical organization

1-3 Workshop

1.3-1 Planning and building

1.3-2 Lay-out

1.3-3 Logistics (Supplies)

1.3-4 Transportation

1.3-5 Movers

1.3-6 Fluid conducting system

1-4 Warehouse

1.4-1 Organization

1.4-2 Central warehouse

1.4-3 Temporary storehouse for works under operation and equipments

1-5 Manufacturing organization

1.5-1 Manufacturing agencies

1.5-2 Work distribution

1.5-3 Planning

1.5-4 Maintenance

1.5-5 General control

2. Office of studies

2-1 Office of studies

2.1-1 Definition of, Technology (Ky thuat hoc may)

2.1-2 Engineering graphics, planning and pre-planning

2.1-3 Engineers and technicians

2.1-4 Research organization

2.1-5 Material organization

2.1-6 Personnel equipment

2.1-7 Documents (or Files ?)

2.1-8 Planning

2.1-9 Project cost estimates

2.1-10 Output of the design service

2-2 Projects - General Principles

2.2-1 Dependence to many factors

2.2-2 Methods of study

2.2-3 Research files

2.2-4 Reports of technical details

2.2-5 Reports of calculation

2-3 Metallic construction

2.3-1 Selection of manufacturing methods

2.3-2 Selection of materials

2.3-3 Size Estimation

2-4 Selection of fabrication methods

2.4-1 **Chipless fabrication**

2.4-2 Machining

3. Analysis of Projects

3-1 Work analysis and measurement

3.1-1 General idea about industrial organization projects

3.1-2 Installations for project preparation

3.1-3 General principles of project analysis

3.1-4 Machine time analysis

3.1-5 Detail instructions form

3.1-6 Technical Terms

3.1-7 Signs and Rules

3-2 Comparis on of Technical Methods

3.2-1

3.2-2 Generation of plane surfaces

3.2-3 Generation of surfaces of revolution

3.2-4 Generation of special surfaces

3.2-5 Surfaces of articulation

3.2-6 Project classification

3.2-7 Fastening of brute objects

3.2-8 Fastening of semi finished pieces for machining

3.2-9 Heat treatment

3.2-10 Power limitation (or limits?)

3-3 Applications

3.3-1 Piece work analysis

3.3-2 Production analysis

3.3-3 Production

3.3-4 Selection of fabrication methods depending on number of mechanisms to be fabricated

3.3-5 Study machine control and testing

4. Study of the Amount of Time needed for the Operation

4-1 General

4.1-1 History of organization

4.1-2 Time and price

4.1-3 Method of studying time

4-2 Study of fabrication factors

4.2-1 Detailed calculation of time for fabrication

4.2-2 Limitation of equipments

4.2-3 Limitation of power

4.2-4 Table of detailed purification time

4-3 Projectobservation and simplification

4.3-1 Project cycle

4.3-2 Work simplification for saving of movements

4.3-3 Fatigue and work organization

4.3-4 Working atmosphere safety

4.3-5 Time record: Rhythm analysis

4.3-6 Time record: at the plant

4.3-7 Time record: Actual working period

4.3-8 Time and movement standard

4-4 Design preparation

4.4-1 Code setting, study of phases

4.4-2 Manufacturing file

4.4-3 Machinery file

4.4-4 Preparation for a turning phase

4.4-5 Preparation for a planing phase

4.4-6 Preparation for a cooling and fitting phase

4.4-7 Document fitting at office of methods

4.4-8 Quick analysis of time

4.4-9 Estimation of the manufacturing time

Practice

Practice using printing machines. Apply theories to school building and equipping projects. Study projects of production applicable in school shops.

314 (32 - 00) BUSINESS ADMINISTRATION

General:

Guidance students in the first steps in directing personnel in a plant and organizing workers under their control.

Contents:

1. Technics of Directing
   - 1-1 Function of a director
   - 1-2 To understand co-workers
   - 1-3 Required abilities at work
   - 1-4 To comment and to grade co-worker's ability.
   - 1-5 Practice of directing
   - 1-6 Social atmosphere between a director and his co-workers
2. Technics of organization
   - 2-1 Decisive factors fixing the output of a well organized organization
   - 2-2 To study and analyse an existing system of organization
   - 2-3 To draw up and apply a new organization system
   - 2-4 Deputation and responsibity problems
   - 2-5 To foresee and combine works
   - 2-6 Control problems

315 (32 - 00) LABOR AND COMMERCIAL LAW

General:

Commercial Law in general - Individual in commercial business. Thuởng phieu and bank activities. Commercial companies Bankruptcy and property liquidation laws.

Labor law: General rules, labor contract, labor community agreement, worker's salary; worker's representatives in a plant; working conditions; sanity and safety for workers; labor accidents; labor conflicts and methods to solve; labor and social welfare service; title and function of the labor inspector study various cases of conflicts between employers and employees in Vietnamese business.

Contents:

1. Labor Law
    - 1-1 General rules
    - 1-2 Labor contract
    - 1-3 Collective Bargaining
    - 1-4 Worker's salary
    - 1-5 Worker's representatives in a business organization
    - 1-6 Working conditions and sanity for workers
    - 1-7 Labor accidents
    - 1-8 How to solve labor conflicts
    - 1-9 Labor and social welfare service title and function of the labor inspector.

1-10 Study various cases of conflicts between employers and employees in Vietnamese business.

2. Commercial Law:

   2-1 Commercial law in general

   2-2 Individual involvement in commerce:

      2.2-1 Commercial acts

      2.2-2 Businessman

      2.2-3 Commercial shops

      2.2-4 Commercial courts and the chamber of commerce

   2-3 Securities and banking activities:

      2.3-1 Securities

      2.3-2 Bill of exchange

      2.3-3 Checks

      2.3-4 Banking activities

   2-4 Commercial Companies

      2.4-1 Corporations

      2.4-2 Partnerships

      2.4-3 Limited responsibility companies

      2.4-4 Joint stock company

      2.4-5 Anonymons company

      2.4-6 Shareholders and managers

   2-5 Bankruptcy and legal liquidation of property

316 (32 - 00) ECONOMY

General:

Economics factors - Production factors: labor, natural resources, capital, funds, stages of production: pre-capitalism phase, capitalism phase, markets and prices, competition, monopoly, demand and supply, customs, monetary problems.

Contents:

1. Factors of Economic Problems
   - 1-1 Study of Works
     - 1.1-1 Profit works - Non profit works
     - 1.1-2 Problems of distribution of works
     - 1.1-3 Work organization according to scientific methods
   - 1-2 Study of Population
     - 1.2-1 Composition of population of a country
     - 1.2-2 Birth rate - Death rate
     - 1.2-3 Conditions and influences of the increase or decrease of population.
     - 1.2-4 Emigration
2. Factors of Production
   - 2-1 Human labor
   - 2-2 Nature
     - 2.2-1 Natural power sources
     - 2.2-2 Natural resources
   - 2-3 Capitalistic Factor: Capital

3. Stages of production

    3-1 Pre-capitalism phase

        3.1-1 Agricultural production

        3.1-2 Handicrafts production

    3-2 Capitalism Phase

        3.2-1 Enterprises (xí nghiệp)

        3.2-2 Specialization of enterprises

        3.2-3 Centralization

            3.2.3-1 In industrial enterprises

            3.2.3-2 In commercial

            3.2.3-3 Kinds of centralized

                3.2.3.3-1 Vertically centralized

                3.2.3.3-2 Horizontally

    3-3 Ex-capitalism phase

        3.3-1 Cooperatives

            3.3.1-1 Producer's cooperative

            3.3.1-2 Consumer's cooperative

        3.3-2 Nationalized business

4. Markets and Prices

    4-1 General idea about markets

    4-2 Free and limited competition

    4-3 Monopoly

    4-4 Other aspects

4-5 Supply and demand

4-6 Relationship between price and supply and demand problems

4-7 Govermental measures on prices:

4.7-1 Taxes

4.7-2 Aids (Tro cap)

4.7-3 Indirect procedures

5. Money

5-1 History of money

5-2 Hard money

5-3 Soft money

5-4 But te

5-5 Role of banks in economics

5-6 Forms of credit

318 (48 - 00) TECHNICAL AND SCIENTIFIC ENGLISH

Train students to read and understand scientific and technical books and documents. Help them to discuss and express technical ideas fluently, simply yet precisely (in both conversation and writing).

Training materials are drawn from books, magazines and reports of modern technology. Technical terms must not be taught seperately as dull vocabulary lessons but must be emerged into the readings and discussion.

321 - 421 (64) PHYSICAL EDUCATION

General:

The aims of physical education are to train students to have a sane body and mind and to teach them the technics of individual and group sports, also to provide a sane recreation after many hours of hard study.

Contents:

1. First period: Covers 14 weeks of the First Semester (October, November and December).
   - 1-1 Giving some concepts of physical education with health examinations, contests and performance records, division into groups and marching in the playground.
   - 1-2 Eleven weeks for technics training
2. Second period: covers 15 weeks of the Second Semester (January, February, March and April).
   - 2-1 The first seven weeks is for gradual training to check the result of the first period training, completion of general technics, practice of former movements, study of new movements and correction of weaknesses.
   - 2-2 The following 8 weeks will increase the bodily growth and strength to prepare the students for the final examination exercises.

3. Third Period: At the end of the schoolyear. It is the time to maintain the effects of the training, and sports which help students relax their minds to prepare for their coming examination and keep the trained virtues, physically as well as spiritually, will be performed.

402 (48 - 32) PRODUCTION AND USE OF STEAM

General:

Heat transfer phenomina

Boilers and Concensors

Fuel and furnace.

Water used in boilers

Use, maintenance and repairment of boilers and accessories.

Practice boilers now used in industry

Contents:

Theory

1.

1-1 General

1.1-1 Definition

1.1-2 Cycles

1.1-3 Sketch plan

1.1-4 Efficiency

1-2 Heat Transfer

1.2-1 General

1.2-2 Heat transfer

1.2-3 Radiation

1.2-4 Convictions

1.2-5 Heat transfer through a homogeneous wall, between two mediums having different temperatures

1.2-6 Heat transfer between two moving fluids having temperature changing according to the length of the wall.

2. 2-1 Boiler Calculations

2.1-1 Different kinds of calculations

2.1-2 Project design

2.1-3 Examples

2-2 Description (x)

2.2-1 Plant layout

2.2-2 Tanks

2.2-3 Steam tubes

2.2-4 Boilers

2.2-5 Preheaters

2.2-6 Accessories of a boiler

2-3 Dissolved gas removal (x)

2-4 Combustion air (x)

2-5 Fuel and furnaces (x)

3.

3-1 Water used in the boiler

3.1-1 Methods of production

3.1-2 Deposits

3.1-3 Corrosion

3.1-4 Turbulance

4. Condensation (x)

    4-1 General

    4-2 The vacumn in the condensation set

    4-3 Heat transfer in the condensation set

    4-4 Structure of a boiler

5. Use, maintenance and reparation of the boiler the condensation set and its accessories. (x)

Practice all subjects marked (x) by visiting or participating in the works.

Other subjects will be practiced by solving guided problems in classe.

403 (64 - 64) HEAT ENGINES

General:

Combustion engines: Study the engines under the prism of thermodynamics and mechanism. Natural air, air injection, ignition. Description parts of engines; use and maintenance of engines. Two stroke engine. Diesel engine: general study. Burning of materials. Combustion chamber and its engines. Diesel engines, use and maintenance.

Steam turbine: theory. The communication of steam in a steam turbine. The movements of turbine. Its power and consumption. Use and maintenance.

Contents:

1. Combustion Engines
   - 1-1 General study of thermodynamic and mechanic aspects.
     - 1.1-1 Theoretical diagram, practical diagram
     - 1.1-2 Study in details and actual cycle
     - 1.1-3 Couple of an engine and its power
     - 1.1-4 Standard characteristics of a combustion engine
     - 1.1-5 Air burning
   - 1-2 Air mixing
     - 1.2-1 General
     - 1.2-2 Simple mixing mechnisms
     - 1.2-3 Supplementary functions of the air mixing mechanisms
     - 1.2-4 Determination of air mixture

1.6-3 Distribution

1.6-4 Controlling instruments

1.7 Use and maintenance

1-8 Two stroke engines

2. Diesel Engine

2-1 General study

2.1-1 General classification

2.1-2 Theoretical cycle

2.1-3 Cooling

2.1-4 Actual cycle

2.1-5 Efficiency, Heat balance

2.1-6 Contrasting characteristics of a diesel engine

2-2 Combustion chamber

2.2-1 Study the combustion

2.2-2 General study of fuel

2.2-3 Combustion chamber

2.2-4 Mechanisms of combustion chamber cylinder, tăng lót, nắp

2.2-5 Air supply

2.2-6 Exhaust gases

2-3 Diesel engines

2.3-1 Moving mechanisms

2.3-2 Fixed

2.3-3 Distribution

2-4 Use and Maintenance

3. Steam Turbine

3-1 General

3.1-1 Theory

3.1-2 Theoretical cycle

3.1-3 Mechanic operation

3.1-4 Methods of thực hien

3.1.4-1 "Force" turbine

3.1.4-2 "Force" and "pressure decreasing turbine

3.1.4-3 "Force" and speed decreasing turbine

3.1.4-4 Power turbine

3.1.4-5 "Mixed" turbine

3-2 Water flow in turbines

3-3 Operation of the whole of turbine

3.3-1 Deseription of parts

3.3-2 Efficiency and energy loss

3-4 Power and Consumption

3-5 Use and Maintenance.

404 (32 - 32) MACHINERY STUDY

General:

Application of theories learned in lower grades:

Study subjects such as: metallic constructions, Hoisters, Hoister Machinery, Ball bearing brake, Springs, Gears, Links, Belts and so on.

Contents:

Subject 404 can be considered as an application of other subjects which students have bearned in lower grades or in the fourth year as heat transfer, construction technology, fluids etc..., esp. material testing.

The program consists of a number of projects to study under the guidance of professors with subjects ordered by them, for example:

- Metallic constructions
- Hoisters
- Hoister machinery
- Ball bearing
- Brakes
- Springs
- Gears
- Belts
- Links
- Miscellaneous

405 (48 - 128) SPECIALIZED TECHNOLOGY FOUNDRY

General:

Practice theories about fabrication methods of metallic products, particularly in foundry: iron, cast-iron, steel, non-iron alloy. light alloy.

- Kinds of sand used for moulds, their characteristics and applications.
- Blast furnace (physical and chemical reactions and phenomena within the furnace, installation)
- Methods of organization and operation a cast-iron plant. Cast-iron applications in industry.
- Copper alloy, light alloy: theory and application in foundry industry

Contents:

1. Materials for Mold making
   - 1-1 How to make a mold: quality, composition, characteristics and classification of materials.
   - 1-2 Kinds of materials used in foundry
2. Blast furnace
   - 2-1 Phenomena in the furnace
     - 2.1-1 (Melting phenomena and reactions of materials, effect of the air blown into the furnace)
     - 2.1-2 Chemical reactions between melt materials (before the melting, at liquid state and when the liquids lie down at the bottom of the furnace).

2-2 Structure of a blast furnace: size, important details (refractory brick).

Steel plates, bottom of the furnace, tap hole, how to repair the refractory bricks.

2-3 Operation of the blast furnace: composition of materials. Burner. Control of furnace common troubles.

2-4 Method of directing a foundry

2.4-1 Materials: coal, iron alloy. Supplementary material.

2.4-2 Arrange materials in a furnace

3. Metallurgy and kinds of cast-iron:

3-1 General, definition

3-2 Study the cooling (according to the diagram of C-Fe balance)

3-3 Characteristics of each element:

Graphile - Perlite - Ferrile - Cementile

3-4 Physical characteristics of cast iron (Maurer - Osann)

3-5 Applications and classification

4. Copper Alloy Foundry Industry

5. Light alloy foundry Industry

407 (48 - 128) Specialized Technology:
FORGING, SOLDERING AND MOLDING

General:

The program of Contruction Technology of the fourth year aims at bringing the students a detailed knowledge of methods of forging, soldiering and moulding in industry.

These theoretical lessons will help the students to solve the problems they will meet in forging and soldiering shops.

Forging:
- Equipments in a forging shop
- Methods of forging; cach nuóng, heat treatment, moulding, forging with temperature, examining results.
- Furnaces: types, usage
- Fuel

Moulding:
- General, definition. Applications and uses in industry. Methods of moulding and processing metals into products.

Welding:
- Gas Welding
- Theory, methods, product examination, reparation, cutting by acetylene welding torch.
- Welding by propane.

Electrical welding: definition, methods of welding by electricity and maintenance.

Contents:

1. Forging:

1-1 Soldiering and Forging Equipments

1.1-1 Forging hammer: cutters, borers, shapers.

Material handling.

1.1-2 Forging furnaces: common forging furnaces. Fuel. Smoke stack.

1-2 Large forging equipment

1.2-1 Hammer, common

1.2-2 Steam driven hammer

1.2-3 Air driven hammer

1.2-4 Use and maintenance of hammers

1-3 Iron Heating

1.3-1 Method of heating iron

1.3-2 Temperature control

1.3-3 Temperature measurement instrument

1-4 Metallurgy

1.4-1 Changes of metals when burned

1.4-2 Hardening

1.4-3 Re-heating

1.4-4 Processing metals by chemicals

1.4-5 Restoration of metals' nature

1-5 Forging effects:

1.5-1 Continuous changing of area

1.5-2 Drawing

1.5-3 Shearing

1.5-4 material surfaces

1.5-5 Vo cong

1.5-6 Hot moulding

1.5-7 Continuous piercing and boring

1-6 Hot moulding

1.6-1 General: moulding equipments

1.6-2 moulding hammer

1.6-3 Use and maintenance of moulding hammer

1.6-4 Hot molding without molds

1.6-5 Hot molding with molds

1.6-6 Applications to non-iron metals

1.6-7 Completion and grinding with sand

1-7 Forging with pressure

1.7-1 Pressure machine used in machinery forging

1.7-2 Forging machines

1.7-3 Patterns and molds

1-8 Examination

1.8-1 Material

1.8-2 Processing technics

1.8-3 Nature and characteristics of metals after being processed

1-9 Furnaces

1.9-1 Furnaces using hard fuel

1.9-2 Furnaces using liquid fuel

1.9-3 Furnaces using gas

1.9-4 Electric furnaces

1.9-5 Prefractory materials

1-10 Fuel

1.10-1 Hard fuel: Charcoal - pulverized coal - coke - peat - lignite.

1.10-2 Liquid fuel: fuel oil - gasoline, other hydrocarbon fuels

1.10-3 Gas fuel: natural gas, coal gas, butane gas

1.10-4 Propane gas

1.10-5 How to select fuel

2. Molding

2-1 General

2.1-1 Definition of molding

2.1-2 Uses of moulding in industry

2-2 Transformation of steel plates

2-3 Molds:

2.3-1 Mold forms

2.3-2 Molding speed

2.3-3 Drill speed

2-4 Methods of calculating preliminary steel plates - Methods of calculating pressures methods of calculating energy.

2-5 Molding cylinder shapes: Calculations and applications

2-6 Molding semi - spherical shapes: calculations and applications.

2-7 Moulding perpendicular shapes: calculations and applications.

2-8 Capacity of compression machines - Kinetics of flywheels -

2-9 Methods of molding specific shapes

2-10 Lubrication - Forces concerning to machinery. Materials for lubrication and their qualities.

2-11 Processing molded metals, metal burning

3. Welding

3-1 General

3.1-1 Definition of autogenous welding

3.1-2 Classification

3-2 Welding

3.2-1 Theory of welding and equipments

3.2.1-1 Welding rods

3.2.1-2 Capacity - Control of the welding torch

3.2.1-3 Kinds of welding. Choosing welding rods, maintenance. Errors while welding.

3.2.1-4 Oxy bottle - How to take care of it. Oxy systems Distribution of liquid oxy.

3.2.1-5 Acetylene - Pressure - Capacity of Acetylene bottle - Acetylene production.

3.2.1-6 Pressure regulator - How to fix and to use it. Maintenance.

3.2.1-7 Welding hoses

3.2.1-8 Glass blowing

3.2.1-9 Difficulties in welding

3.2-2 Technics of Common Steel Welding

3.2.2-1 Shapes of joints, preparations for joining

3.2.2-2 Study in general qualities of principal and auxiliary metals. Space between "rod" and metals degree of inclination of rod.

3.2.2-3 Methods of welding

3.2.2-4 Examining soldered joint. Errors. Check by X ray.

3.2.2-5 Shrinking and extension of metals. Reparation after welding.

3.2-3 Technics of brazing on a metal. Classification. Common brazing and anti-corrosive brazing. Brazing on a metal mixture.

3.2-4 Technics of welding other metals (besides steel). Metals subjected to welding. Metals subjected to be oxydized. Steel welding, unoxydized welding. Copper welding. Brass welding. Aluminium welding. Zinc welding lead welding.

3.2-5 Technics of welding foundry machinery. Preheating. Cast-iron welding. Brass welding.
Aluminium welding.

3.2-6 Brass, Brazing. Brass brazing to join two mechanisms. Applications of brass, brazing into metals.

3.2-7 Oxy - Acetylene cutting
Theory. Cutting torch. Technics of cutting.
Errors. Cutting by machinery. Technics of machine cutting.

3-3 Propane:

3.3-1 Oxy - Propane welding torch

3.3-2 How to weld

3.3-3 How to take care of propane bottle

4. Electrical Welding

4-1 General

4.1-1 Definition of autogenous electrical welding

4.1-2 Methods

4-2 Electrical welding theory and equipments

4.2-1 How to weld. Electric currents and their intensities.

4.2-2 Welding flux, conducting wires. Grounding clip, chipping hammer, steel brush, how to choose flux.

4.2-3 Auxiliary electrical welding components.

4.2-4 Welding glasses and gloves.

4-3 Technics of electrical welding on common kinds of steel.

4.3-1 Shapes of welded joints - Preparation for joints

4.3-2 Methods of electrical welding

4.3.2-1 Butt welding

4.3.2-2 Exterior edge welding

4.3.2-3 Lap welding

4.3.2-4 Interior edge welding

4.3.2-5 Vertical welding

4.3.2-6 Horizontal welding

4.3-3 How to weld. Control of torch. Control of power

4.3-4 Calculation of the prime cost of a electrically welded joint. Consumption of energy. Labor cost.

4.3-5 Check soldered joints. Usual check.

Examine welded lines - Examine welded joint when broken.

Check by X ray.

4.3-6 Shrinking and extending of metals.

Modifications after welding.

4-4 Brazing

4.4-1 Common brazing

4.4-2 Anti corrosive brazing

4-5 Electrical welding technics used for metals other than common steel.

Steel welding. Non-oxidized steel welding. Cast iron welding.

Brass welding. Nickel welding. Aluminium welding.

4-6 Special welding technics

4.6-1 General

4.6-2 Contact resistance welding

4.6-3 Hydro ion welding.

4.6-4 Argon welding, heli arc

408 (46 - 00) COMMERCIAL ACCOUNTING

General:

Account. Inventory. Journal. Ledger. Balance. Method of noting in a journal. Use of ledger. Ledger balancing

Contents:

1. Accounts
   - 1-1 Definition
   - 1-2 Description
   - 1-3 Types
   - 1-4 Open an account, close an account.
   - 1-5 Operate an account
   - 1-6 Accounting, checking
2. Inventories
   - 2-1 Permanent inventories
   - 2-2 Periodical inventories
3. Journals
   - 3-1 Description
   - 3-2 Correction of errors
4. Ledgers
   - 4-1 Description
   - 4-2 To handle a ledger
5. Balance
   - 5-1 Description

5-2 How to establish a balance

5-3 Correction of errors

6. Ledger entries

7. Listing

7-1 Tasks to be completed at year's end

7-2 Annual balance

7-3 Balance sheets

8. Opening and closing ledgers

418 (48 - 00) SCIENTIFIC AND TECHNICAL ENGLISH

See 318

320 + 420 (32 - 00) PROFESSIONAL GUIDANCE

Guide and help students in any activities of the school. Answer to students' questions about their profession. Promote companionship develop leadership and spirit of responsibility.

4?3 (48 - 48) ENGINES

General:

Methods of calculation and realization a project of making a combustion engine.

Contents:

This course aims at training students how to calculate and realize a project of making a combustion engine according to a criterion they select. This course can be considered an application of students' knowledge of technology, engines and other common subjects. Students must submit a report in the form of a project of an engine they have studied during the year (under the guidance of their professor).

434 (48 - 48) REFRIGERATION INDUSTRY

This course will complete the basic course of Refrigeration Industry 312 of the third year aiming at helping students to explore the professional aspects of the industry so that they won't be embarassed once entering in this field later. In theory, they will study refrigeration cycle, unit system, central system, and industrial air conditioning. In practice, they will practice repairing common damage in the unit system, drawing a project of establishing a commercial installation and will broaden their professional knowledge by studying a refrigeration system of a commercial or industrial establishment.

Contents:

Theory

1. General
   - 1-1 Basic refrigeration cycle
   - 1-2 Absorption refrigeration cycle
2. Unit System
   - 2-1 Main parts
     - 2.1-1 Evaporation mechanism
     - 2.1-2 Gas pressure mechanism
     - 2.1-3 Condensation mechanism
     - 2.1-4 Moisture filter
     - 2.1-5 Expansion value
     - 2.1-6 Transfer tubes

2-2 Electrical components

2.2-1 Electrical energy source

2.2-2 Motors

2.2-3 Condenser

2.2-4 Thermostatic controls

2.2-5 Electrical overload controls

2.2-6 Pressure control

2-3 General methods of maintaining and repairing common damage

2-4 Electrical diagram of some kinds of machines

2-5 Method of calculating refrigeration output according to "ARI FORM"

3. Central System

3-1 Central Station Unit

3-2 Built up system

3-3 Method of calculating refrigeration output in detail

3-4 Blowers, dehumidifiers, filters, coils

3-5 Ducts - Selection

3-6 Air distribution

3-7 Control systems

4. Industrial Air Conditioning

4-1 Method of calculating refrigeration output resulting in below or above 32°F.

Practice:

Repair common damage of unit system; draw a refrigeration project for a commercial establishment; visit and study a refrigeration system of an industrial or commercial establishment.

A P P E N D I X C

PHOTOS OF MECHANICAL ENGINEERING FACILITIES

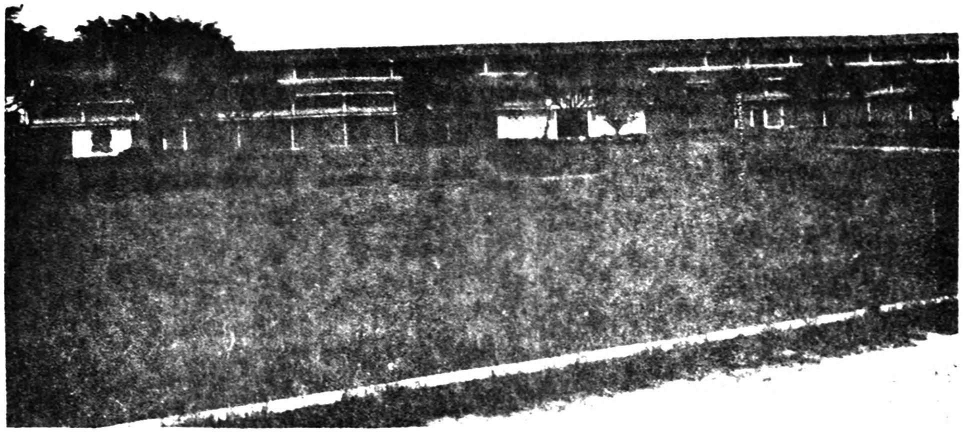

Figure 2 Physical Facilities Building

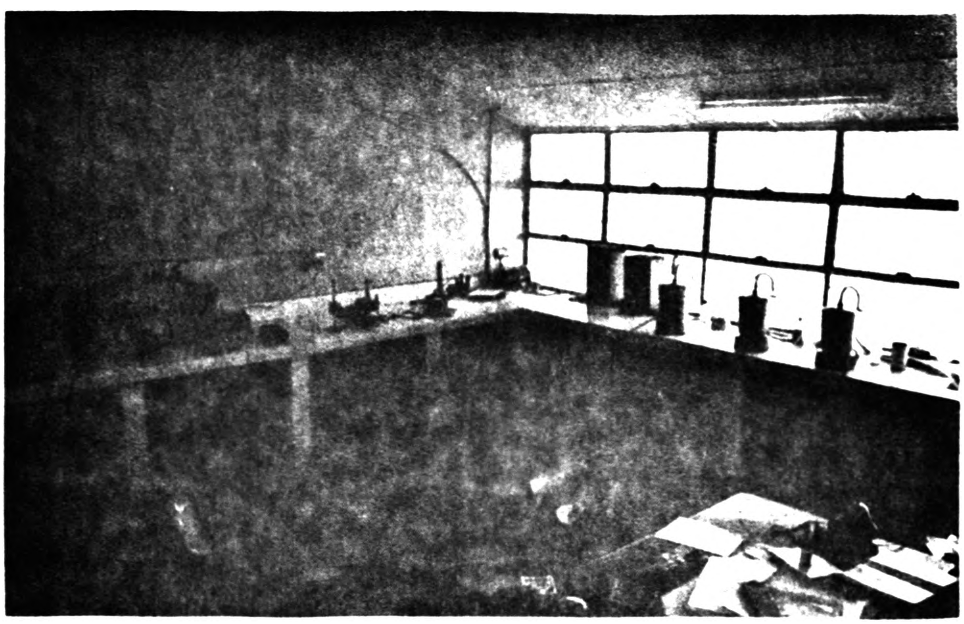

Figure 3 Metallurgy Laboratory

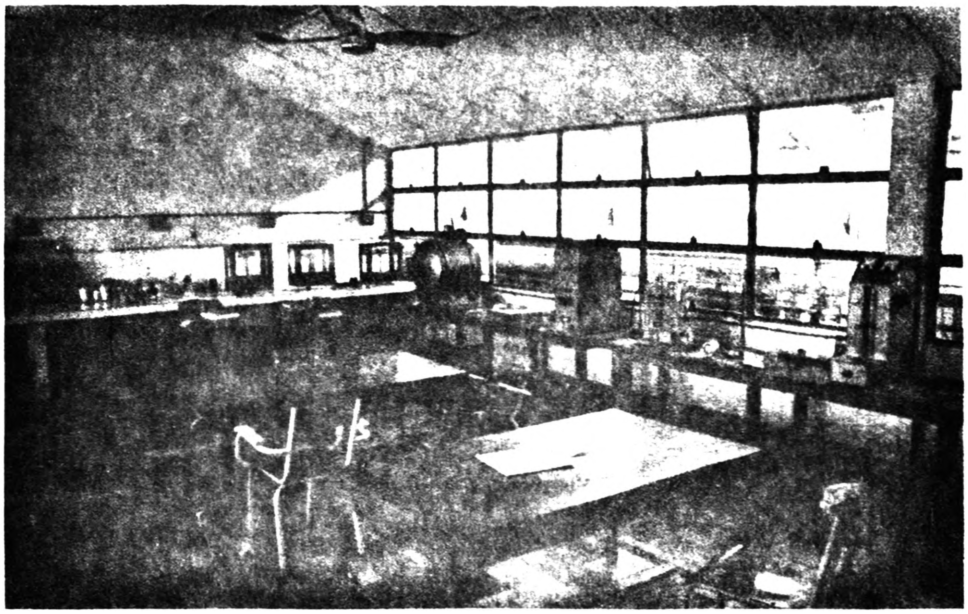

Figure 4 Chemical Laboratory for Metals

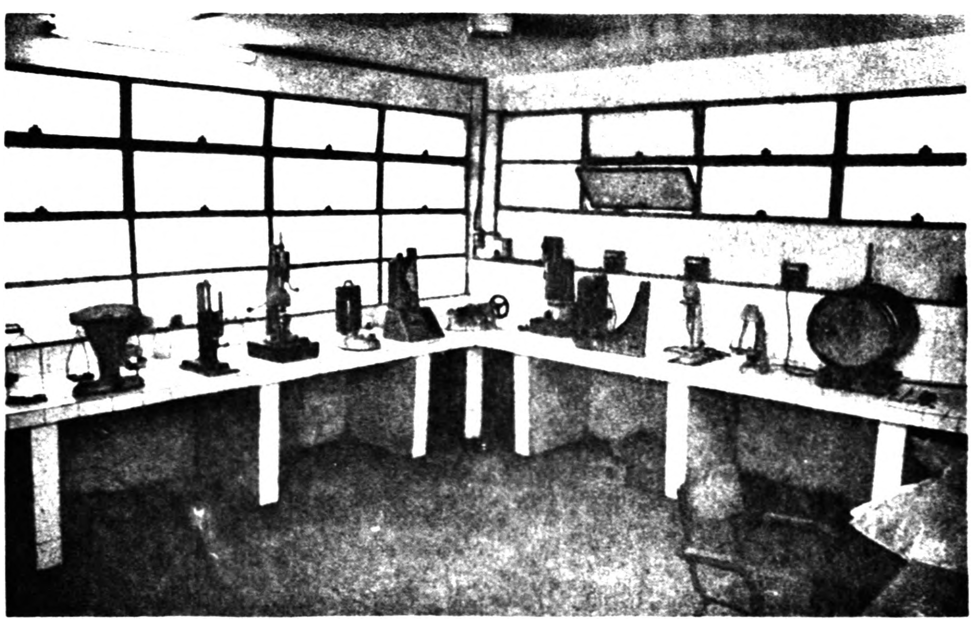

Figure 5 Sand Laboratory

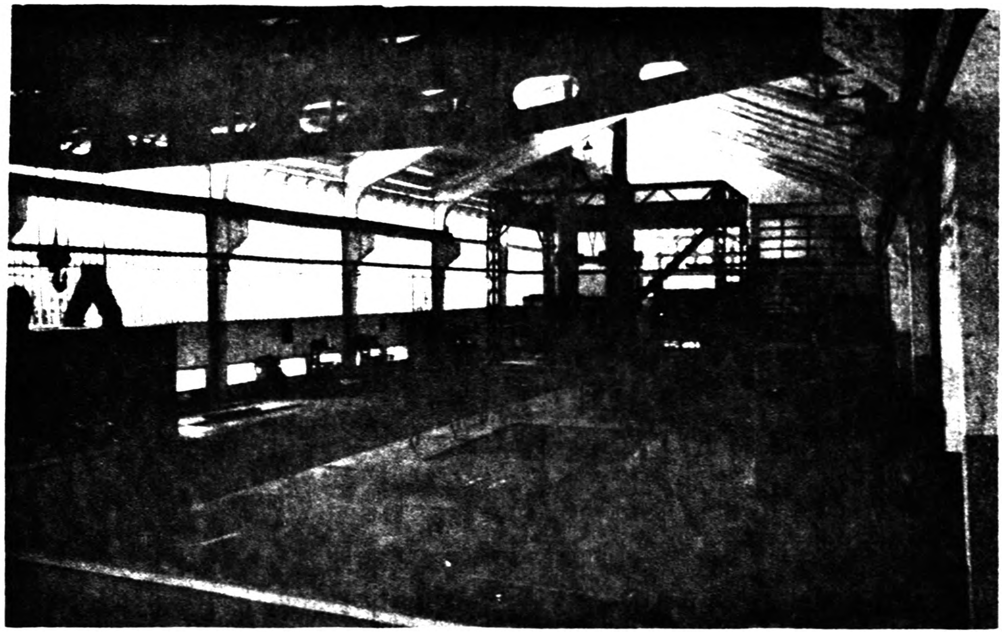

Figure 6 Foundry

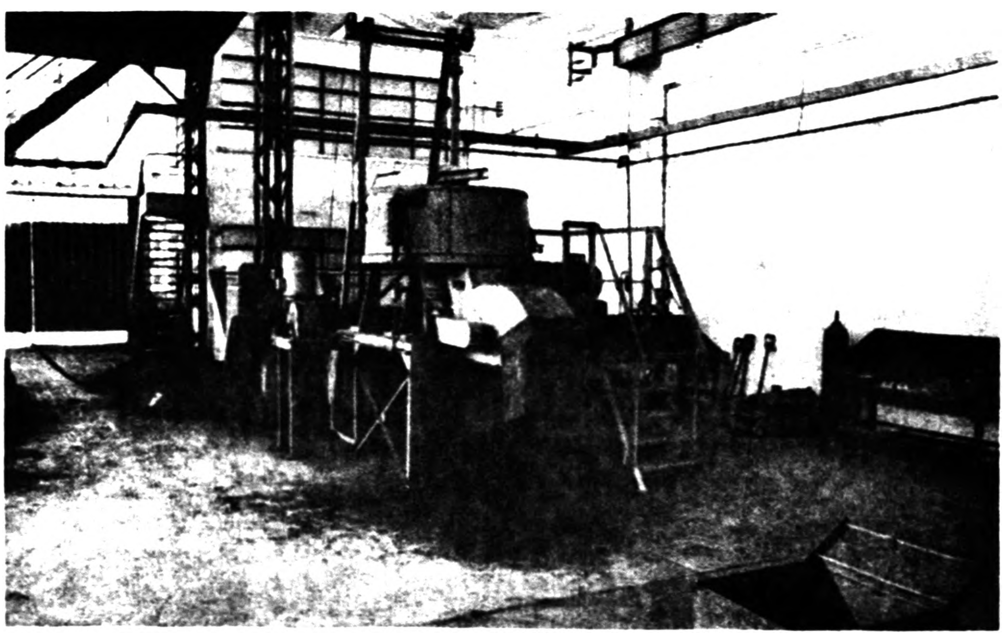

Figure 7 Sand Conditioner

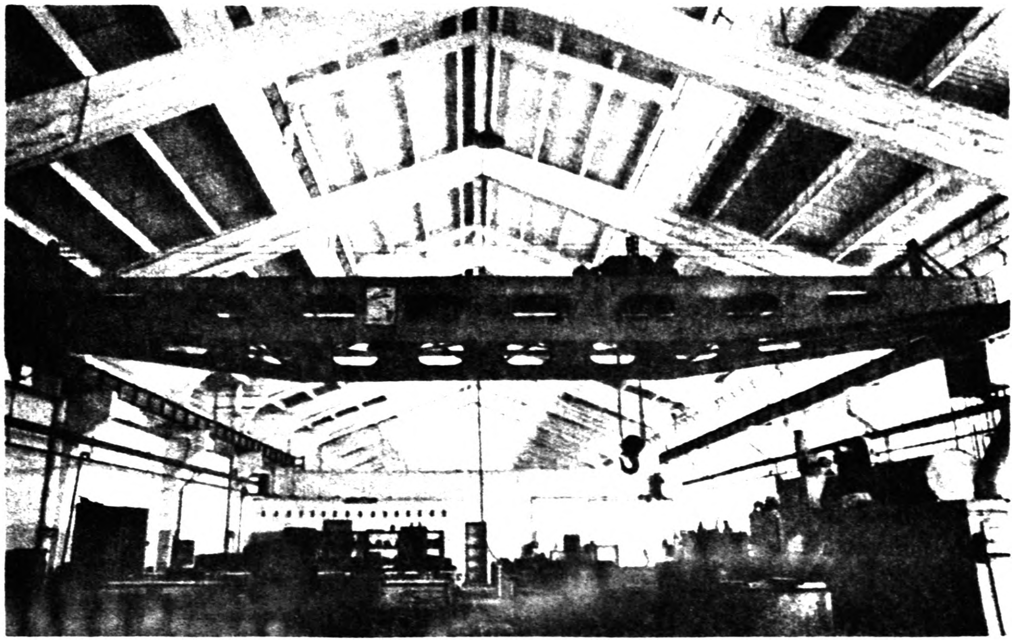

Figure 8 Cverhead Crane

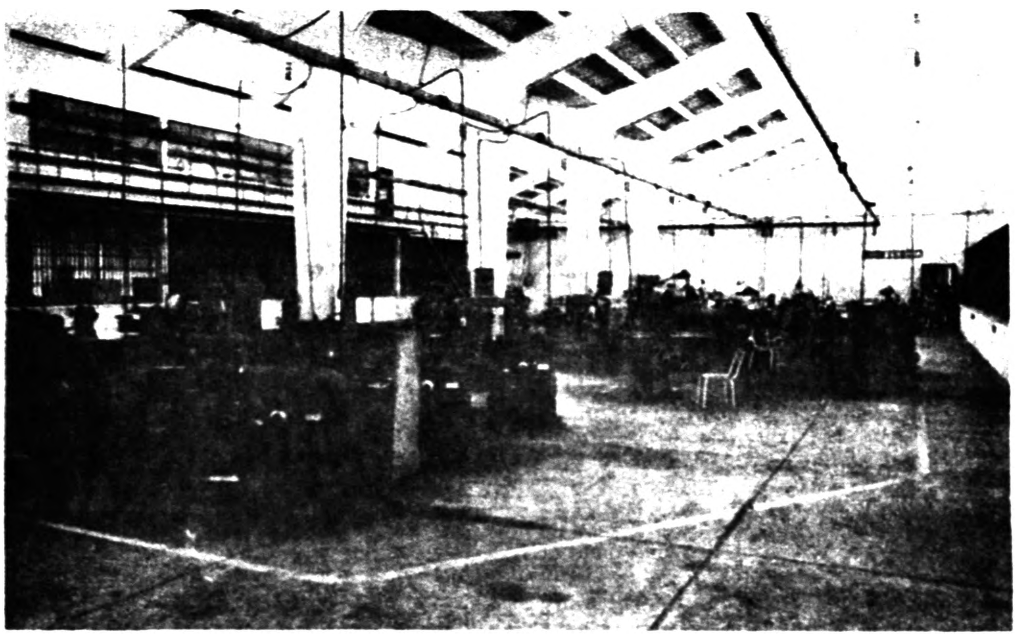

Figure 9 Machine Shop

A P P E N D I X   D

VIETNAM COLLEGE OF ENGINEERING
(Written July, 1970)

VIETNAM COLLEGE OF ENGINEERING

by

Myrne R. Riley

The National Technical Center is presently composed of the Civil, Chemical, Electrical, and Mechanical Engineering Schools and the Merchant Marine School. The Engineering Schools offer a four year engineering program leading to the Ky Su, KS, Degree. The Schools of Civil, Chemical, and Electrical Engineering also offer a two year advanced technician training program in their respective disciplines. The Mechanical Engineering School does not offer a technician program but shares its facilities with those schools which do. The Merchant Marine School trains merchant marine technicians at a sub-engineering level and has no engineering degree program. The Engineering Schools offering technician training handle all of the administrative work and provide the faculty and facilities for both their degree program in engineering and for the technician training program. Consequently, neither of these programs is completely autonomous.

The technician courses are completely separate from the engineering courses and carry no credit for possible application towards an engineering degree should the student so elect. These students are more than just tradesmen. They are disciplined in more of the why of the technical arts than are tradesmen, so they receive more theoretical and analysis work than just primary skill work. Their support role will be of tremendous value to the development of Vietnam.

Presently, the Polytechnic High School, the Advanced Technician Training program, and the Engineering Schools are located at the same site. A decision based on previous experience must be made as to whether this is a desirable arrangement.

UNESCO is presently committed to the technician program according to their operational plan dated January 22, 1968 and adjusted by Adjustment Advise No. 1 signed on January 23, 1970. The extent of their support is outlined in the accompanying charts. More detailed descriptions can be found in the operational plan. Their program with current adjustments but not including possible adjustments in progress called for a separation of engineering and a formation of the NTI back in 1969 on the existing Phu Tho site with engineering moving to the proposed Thu Duc location.

Enrollment goals of UNESCO for advanced technician students called for an increase to 2000 students by 1970 from the present 310 students. This goal has been readjusted by ten years. The presence of engineering at Phu Tho will continue to block their goals. The original goal has been readjusted to be met by 1980. It is evident that the Phu Tho location is not adequate to house both the expansion of technician training desired and the expansion of engineering education.

The Phu Tho location is adjoined by complexes which limit its boundaries. Possible expansion is limited to the North by an old ammunition dump, to the South by a military hospital complex, to the East by a military depot, and to the West by a highway.

Considering the possibility of UNESCO assuming the responsibility for engineering education, it would take approximately one year to formulate an operational plan as was done for technician training. Another six months to a year would be required to recruit the appropriate engineering advisors and to get underway with their program.

Based on USAID's experience, education contractors are required to recruit at least 50% of the staff members who are assigned to the contract from among their own faculty. UNESCO has no such requirements and uses advisors of all nationalities. Presently, the personnel of UNESCO are fully qualified for advising the advanced technician program, but a new team would be required for assuming the engineering effort.

Their intent from the beginning when they proposed their program was to completely break off the technician program from the engineering and form the proposed NTI which was to include the advanced technician program and the Polytechnic High School. Their efforts to date have kept this goal in view.

Most of the laboratories which now exist at Phu Tho are at the shop level and provide excellent training for technicians but are entirely inadequate for training engineers. The fact that Vietnam is a developing country does not dictate, entirely, the type of engineers needed. In a developing country the initial push in industrial development requires a source of engineering external to the country. This comes in the form of the technology which accompanies the installation of complex manufacturing processes, refineries, and many types of equipment of a foreign origin. Perhaps the largest number of engineers will be needed to operate and maintain this equipment. It will be necessary for the engineer to be adequately trained in practical technology but more particularly he must also have the capability of design to improvise his equipment since there will evolve from this foreign input the necessity to change machinery, make new machines locally in the plants, and provide many broader functions than normally found in a plant of a developed country. Much of this is necessitated by the extremely long shipping times for procurement and the lack of an extended manufacturing base in country which would provide many of the items needed for plant operation and maintenance. Consequently, the engineer must be provided not only experience at the shop level but practical experience with sound engineering fundamentals in the laboratory. There is currently an over balance towards shop work and very few facilities for training experience in engineering fundamentals.

The problem of recognition by the government but particularly by the academic community is vital in establishing a higher educational institution such as a college of engineering. In order for there to be proper interchange of professionalism, ideas, and even assistance, barriers of superiority/inferiority must be broken down. The establishment of a college of engineering, a higher educational institution, with a technician school and a polytechnic high school will only add to the unfavorable attitude which already exists in the academic community. These problems are real and cannot be overemphasized. An institute of this type needs support from various government levels and the academic community and should be established as an engineering college either as an autonomous institute or as a college of a university system. Then it can be recognized as an institute of a higher level without being associated with lower level schools.

There are several propositions for the future of the engineering schools which have merit. First, due to the present lack of money for buildings, a temporary residence at the present Phu Tho location might be suggested. However, a separation of the administrative organization, the budgets, and the faculty of the engineering school from the technology school should be made. Faculty from the engineering schools might be hired to teach a few technician courses but this should not be encouraged.

The adoption of this proposition must be accompanied by a workable schedule for constructing well planned buildings for the engineering schools. If Vietnam is to have an institute which can train engineers for their present and future needs, the necessity of a building program must be realized and actively pursued. Staged construction, good planning and efficient scheduling of use of each stage as it is completed can bring about the establishment of an autonomous engineering college sooner than may be realized. There are basically very few laboratories at the engineering level at the Phu Tho site and such might be the case during the first stages of construction at a new location.

The successful establishment of the National Military Academy of Vietnam at Dalat was programmed on the basis of staged construction. The designs for the academy facilities were made initially and a five year staged construction program was instituted in 1960 to meet the basic needs. Other buildings such as the headquarters building, the library, the service area building, and the large equipment laboratories were built over the following five years giving a staging period of ten years. Use of the facilities occurred within two years after the start of construction.

Such can be the case for the college of engineering if the efforts of all concerned are programmed to do so, the proper decisions made to do so and goals set now for the inactment of this type of program. If Vietnam is to meet the challenge of the high rate of development initiated by the presence of the United States and its development programs, these decisions must be made very soon.

Second, the establishment of an engineering college at an intermediate site will take away from the training efforts what advantages exist if Phu Tho is used as the intermediate site. Assuming that the same period of time will elapse for expansion and programming a quality school regardless of the intermediate location, Phu Tho can provide a suitable situation if efforts get underway for a permanent location. The identification of engineering as a higher educational institution can be started by an organizational separation of engineering from technician training at Phu Tho.

Third, considering the great expense which has gone into equipment for the advanced technician training program and since few engineering laboratories have been established, one must conclude that it would be best if the technician program remain at Phu Tho.

A N N E X E I

INSTITUT NATIONAL TECHNIQUE, SAIGON, VIET-NAM

Programme des Dépenses

Allocation du Fonds Spécial

(En Dollars E.U.)

A P P E N D I X I

NATIONAL TECHNICAL INSTITUTE, SAIGON, VIET-NAM

Plan of Expenditure

Special Fund Allocation

(In US Dollars)

	Total en mois-hommes. Total man-months	Coût total du projet Total project costs	Paiements en espèces selon estimation Estimated cash disbursement							
			1966	1967	1968	1969	1970	1971	1972	
1. Experts										**1. Experts**
Conseiller technique principal *	40	105,835	-	30,038	30,797	29,000	16,000	-	-	Chief Technical Adviser *
Electronique générale	30	80,488	-	-	988	26,500	28,900	24,100	-	General electronics
Electronique industrielle	30	72,300	-	-	-	-	24,100	28,900	19,300	Industrial electronics
Production et distribution de l'énergie électrique	34	76,926	-	8,554	24,422	28,300	15,650	-	-	Electrical power production and distribution
Métrologie	30	72,250	-	-	-	-	14,450	28,900	28,900	Metrology
Mécanique des sols et matériaux de construction	34	84,168	-	-	29,068	31,000	24,100	-	-	Soil mechanics and building materials
Hydraulique	34	81,900	-	-	-	-	28,900	28,900	24,100	Hydraulics
Topographie et photogrammétrie	34	81,300	-	-	-	27,100	28,900	25,300	-	Topography and photogrammetry
Thermodynamique et machines de marine	34	81,750	-	-	-	9,500	28,900	28,900	14,450	Thermodynamics and marine machinery
Chimie industrielle (analyses)	24	59,075	-	-	1,275	-	28,900	28,900	-	Industrial chemistry (analysis)
Attaché d'administration	65	105,753	-	7,224	15,529	18,200	21,600	21,600	21,600	Administrative Officer
Chimie industrielle	28	67,400	-	-	-	-	9,600	28,900	28,900	Industrial chemistry
Arts industriels (résistance des matériaux)	32	77,100	-	-	-	-	28,900	28,900	19,300	Mechanical engineering (strength of materials)
Mission d'organisation et d'équipement	4	4,627	4,627	-	-	-	-	-	-	Organization and equipment mission
Consultant : planification	2	5,195	-	1,452	3,743	-	-	-	-	Planning Consultant
Sous-total	455	1,056,067	4,627	47,268	105,822	169,600	298,900	273,300	156,550	**Sub-total**

* Après le départ du Conseiller Technique principal actuellement en poste, un expert de l'une des principales spécialisations sera désigné pour cumuler ses fonctions et celles de C. T.P.

* After the departure of the present Chief Technical Adviser, an expert of the main engineering specialities will be designated to cumulate his functions with those of C. T. A.

A N N E X E I (Suite) — A P P E N D I X I (Continued)

INSTITUT NATIONAL TECHNIQUE, SAIGON, VIET-NAM — NATIONAL TECHNICAL INSTITUTE, SAIGON, VIET-NAM

	Total en mois-hommes / Total man-months	Coût total du projet / Total project costs	Paiements en espèces selon estimation / Estimated cash disbursement 1966	1967	1968	1969	1970	1971	1972	
2. Bourses d'études										**2. Fellowships**
Electronique générale	12	5,000	-	-	-	-	2,000	3,000	-	General electronics
Electronique industrielle	12	5,000	-	-	-	-	-	5,000	-	Industrial electronics
Production et distribution de l'énergie électrique	12	5,000	-	-	-	-	2,000	3,000	-	Electrical power production and distribution
Métrologie	12	5,000	-	-	-	-	-	3,000	2,000	Metrology
Mécanique des sols	12	5,000	-	-	-	2,000	3,000	-	-	Soil mechanics
Hydraulique	12	5,000	-	-	-	-	-	5,000	-	Hydraulics
Topographie et photogrammétrie	12	5,000	-	-	-	-	2,000	3,000	-	Topography and photogrammetry
Thermodynamiques et machines de marine	12	5,000	-	-	-	-	2,000	3,000	-	Thermodynamiques and marine machinery
Chimie industrielle (analyses)	12	5,000	-	-	-	-	-	3,000	2,000	Industrial chemistry (analysis)
Arts industriels (résistance des matériaux)	12	5,000	-	-	-	-	2,000	3,000	-	Mechanical Engineering (strength of materials)
Participation à conférence régionale (Turin: Septembre 1968)		1,036	-	-	910	126	-	-	-	Participation in Regional seminar (Turin: September 1968)
Sous-total	120	51,036	-	-	910	2,126	13,000	31,000	4,000	**Sub-total**
3. Matériel										**3. Equipment**
a) Equipement du projet en :										a) Project equipment in :
Matériel électronique		40,000	-	41	8,896	10,000	11,063	10,000	-	Electronics
Machines électriques		30,000	-	-	-	10,000	10,000	10,000	-	Electrical machines
Matériel de mécanique des sols et de topographie		60,000	-	-	-	15,000	30,000	15,000	-	Soil mechanics and Topography
Matériel thermodynamique et machines de marine		65,000	-	-	-	10,000	25,000	30,000	-	Thermodynamics and marine machinery
Chimie industrielle		60,000	-	-	-	5,000	30,000	25,000	-	Industrial chemistry
Arts industriels (résistance des matériaux)		50,000	-	-	-	20,000	20,000	10,000	-	Mechanical engineering (strength of materials)
Métrologie		65,000	-	-	-	-	35,000	30,000	-	Metrology
Matériel de reproduction et audio-visuel		15,000	-	-	-	3,000	10,000	2,000	-	Reproduction equipment teaching aids and devices
b) Livres et publications		10,000	-	-	73	2,500	5,927	1,500	-	b) Books and publications
c) Rapport final		5,000	-	-	-	-	-	-	5,000*	c) Final Report
Sous-total		400,000	-	41	8,969	75,500	176,990	133,500	5,000	**Sub-total**

* A soumettre en mars 1973

* To be submitted in March 1973

ANNEXE I (Suite) — APPENDIX I (Continued)

INSTITUT NATIONAL TECHNIQUE, SAIGON, VIET-NAM — NATIONAL TECHNICAL INSTITUTE, SAIGON, VIET-NAM

	Coût total du Projet / Total project cost	Paiements en espèces selon estimation / Estimated cash disbursement 1966	1967	1968	1969	1970	1971	1972	
4. **Divers**									. **Miscellaneous**
Véhicules (2)	7,217	-	-	4,717	-	-	2,500	-	Vehicles (2)
Entretien des véhicules (2)	7,751	-	114	437	1,800	1,800	1,800	1,800	Maintenance of vehicles (2)
Chauffeurs (2)	6,394	-	-	194	1,300	1,900	2,000	1,000	Drivers (2)
Secrétaires (2)	12,970	-	-	1,070	2,800	3,500	3,700	1,900	. Secretaries (2)
Télécommunications, imprévus	9,115	74	68	1,373	1,600	2,000	2,000	2,000	Communications and contingencies
Frais de traduction	900	-	723	119	-	58	-	-	Translation costs
Sous-total	44,347	74	905	7,910	7,500	9,258	12,000	6,700	**Sub-total**
COUT TOTAL BRUT DU PROJET	1,551,450	4,701	48,214	123,611	254,726	498,148	449,800	172,250	TOTAL GROSS PROJECT COSTS
5. Frais généraux de l'Organe d'exécution	170,700	-	73,050	12,750	20,000	20,000	20,000	24,900	. Executing Agency overhead costs
6. Frais directs du Fonds Spécial	681	681	-	-	-	-	-	-	. Special Fund direct costs
ALLOCATION DU FONDS SPECIAL	1,722,831	5,382	121,264	136,361	274,726	518,148	469,800	197,150	SPECIAL FUND ALLOCATION

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ANNEXE III

APPENDIX III

INSTITUT NATIONAL TECHNIQUE, SAIGON, VIET-NAM

NATIONAL TECHNICAL INSTITUTE, SAIGON, VIET-NAM

Contribution totale du Gouvernement

Total Government Contribution

		Equivalent en Dollars E.U. / Equivalent in US $						
	Total	1967	1968	1969	1970	1971	1972	
Contribution de contrepartie en nature 1/	6,357,200	4,807,200	405,000	283,100	286,700	287,600	287,600	Counterpart contribution in kind 1/
Contribution aux dépenses locales de fonctionnement 2/	[illegible],400	37,900	-	38,000	35,300	3[illegible],200	[illegible],000	Contribution towards local operating costs 2/
CONTRIBUTION TOTALE DU GOUVERNEMENT	6,515,600	4,845,100	405,000	321,100	322,000	322,800	299,600	TOTAL GOVERNMENT CONTRIBUTION

1/ Ces sommes ont été calculées au taux de change en vigueur aux Nations Unies qui est de 1 dollar E.U. = 118.- Piastres.*

2/ Ces sommes sont payables en monnaie locale au taux de change fixé par les Nations Unies (qui est fondé sur le taux de change le plus favorable que puisse appliquer le Fonds spécial). Ce taux est actuellement de 1 dollar E.U. = 118.- Piastres.*

* Jusqu'au 31 octobre 1967, calculé au taux de change en vigueur de 1 dollar E.U. = 80.- Piastres. Calculé ensuite au taux de change officiel de 1 dollar E.U. = 118.- Piastres.

1/ These amounts have been calculated at the prevailing United Nations operating rate of exchange of one US dollar = 118.- Piastres.*

2/ These amounts are payable in local currency at the United Nations operating rate of exchange (which is based on the most favourable legal rate of exchange available to the Special Fund), which at the present time is one US dollar = 118.- Piastres.*

* Up to 31 October 1967, calculated at prevailing rate of one U.S. dollar = 80.- Piastres, and subsequently at the current official rate of one U.S. dollar = 118.- Piastres.